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Quality assessment of nutrition coverage in the media: A 6 week survey of five popular UK newspapers

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ABSTRACT

Objectives: This study aims to investigate the quality of nutrition articles in the top five national daily newspapers in the UK and to identify important predictors of quality.

Setting: Newspapers are a primary source of nutrition information for the public.

Design: Newspaper articles were collected on 6 days of the week (excluding Sunday) for 6 weeks in summer 2014.

Outcome measures: A validated Quality Assessment Tool was used to assess each article, with a minimum possible score of -12 and a maximum score of 17. Newspapers were checked in duplicate for relevant articles. Scores and predictors were analysed using one-way ANOVA or independent t-tests.

Results: A total of 141 different nutrition articles were included across the 5 newspapers. The mean (SD) quality score was 1.8 (5.0) indicating that articles were generally of poor quality. Variations in quality of reporting were seen between newspapers however, the difference was not statistically significant *(p=0.19)* due to high degrees of variation of quality score within newspapers. Anonymously published articles were significantly lower quality than those with named journalists *(p<0.01)* with mean (SD) quality score of -1.6 (4.3) compared with 3.2 (4.6) respectively. Smaller articles were lower quality than medium articles with mean quality score of 1.0 (4.8) compared with 4.0 (4.6) respectively *(p=0.04)*. Articles that focused on obesity obtained the lowest mean quality score compared with articles that reported on other health outcomes *(p<0.01)*.

Conclusions: This study confirms that the public are still regularly exposed to poor quality, misleading information about what to eat to promote health. Worryingly, newspaper articles reporting on obesity are very poor quality. Improved training for journalists is recommended. Furthermore, Journalists, academics and health professionals are required to work together to ensure clear, consistent nutrition messages are communicated to the public.

Main strengths:

1. A large number and variety of nutrition articles from the UKs most popular newspapers were included
2. A wide range of important predictors of article quality were identified.

Main limitations:

Many people use online newspapers as a source of health information, which were not included in this survey.

Quality of newspaper articles may vary seasonally but it was not possible to assess this over 6 weeks.

INTRODUCTION

Chronic conditions such as obesity, cardiovascular disease, type II diabetes and stroke are leading causes of death, accounting for 86% of total deaths in the UK[1]. Lifestyle factors such as poor diet, physical inactivity, and excess weight play key roles in the development of these chronic conditions[2 3]. A review by Scarborough*, et al.[4]* highlighted that 33,000 deaths each year could be avoided if the UK dietary recommendations were met. Therefore, raising knowledge and awareness of dietary guidelines in an effort to educate and encourage the public to make a conscious decision about their dietary intake could help to significantly improve the health of the population and reduce the incidence of these conditions[5].

The media is comprised of a wide range of information sources such as the internet, radio, television, smartphones, and printed newspapers. Media communications are shown to have an influential effect on the public's knowledge and awareness of health issues that can promote positive behaviour change[6 7]. Despite an increase in the use of online media, printed newspapers remain the most efficient way of providing the public with essential information[8 9] and tabloid and broadsheet newspapers are often utilised by the public as the primary source of health based information[10]. Therefore, it is likely that good quality reporting by health correspondents plays an important part in improving awareness of health related issues that allows the public to make informed decisions[9].

Previous research has shown that nutrition coverage has often been sensationalist, with headlines not accurately reflecting the scientific research[11]. The media, in turn, have been criticised for their classification of "newsworthy" stories[12] while content analysis of tabloid newspapers highlighted that nutrition coverage lacked context, accuracy and often presented preliminary research as a "breakthrough"[11 12]. The media often presents contradictory messages about health and nutrition[13 14] and health correspondents and journalists are criticised for reporting about health in an unbalanced fashion, where the findings of research are discussed alongside their own opinion[15]. Furthermore, Cooper *et al.*[8] investigated the level of evidence journalists used to support dietary headlines and

health claim. Their findings revealed that the majority of articles (72%) were based on low quality evidence leading them to conclude that the evidence base used by the media was insufficient to support the majority of the health claims made.

Robinson et al.[16] conducted a review of the quality of health based articles in eight of the most popular UK newspapers over 4 weeks. Their findings revealed significant differences in the quality of reporting between the newspapers. With *The Times* publishing the highest quality articles and *The Sun* the lowest. Their findings highlighted aspects of an article that affected the quality of reporting such as article length, journalist, and credibility of source. However, to date, there are only a limited number of studies examining the quality of nutrition coverage in the media and these have been over a short period of 1 to 4 weeks resulting in a small number of included articles and insufficient power to determine important factors in predicting poor article quality. Therefore, the main aims of this study were to use the validated quality assessment tool to assess the quality of nutrition coverage in the five highest national circulating printed newspapers and to determine predictors of low or high quality articles.

METHODS

Data collection

The five highest national circulating tabloid and broadsheet national newspapers in the UK were examined between 30 June 2014 and 9 August 2014. Four tabloid newspapers (*The Sun*, *The Daily Mirror*, *The Daily Mail* and *The Daily Express*) and one broadsheet, (*The Daily Telegraph*) were included in this study. We omitted the Daily Standard from the included list, which was also in the top six newspapers, as it is not available outside London. Both tabloid and broadsheet newspapers were included to understand whether there were any differences in the quality of the nutrition coverage in these forms of media.

Printed editions of the five newspapers were collected on 6 days of the week (Monday to Saturday) for 6 weeks. Sunday was excluded from the data collection as a pilot study revealed repetition of nutrition/health articles from previous days. Each printed newspaper was scanned by a research from cover to cover and articles relating to aspects of nutrition and human health were identified and extracted for inclusion in this study. This process was done in duplicate by a second researcher to ensure relevant articles were not omitted. The selected articles were then reviewed by a third nutritionist and articles that did not adequately meet inclusion criteria were excluded.

Where sufficient information was provided, original research was located using PubMed and other online databases. Articles with insufficient information to locate original research or not based on published research were not excluded. Each article was coded with a unique ID number. Descriptive data such as, article size, date and day of publication, journalist's name, and the newspaper, were extracted for each article. Articles were categorised into aspect of diet and health outcome covered in the publication. Dietary components were categorised according to *The Eatwell guide* (Public Health England, 2016).

Descriptive data

Column inches were measured using the standard method (column inches high x number of columns). Articles were then categorised into either small (≤ 19.9 inches), medium (20 – 34 inches) or large (≥ 35 inches) based on space allocated to article. The cut-off points for these categories were based on the average column inches for less than half page, half a page and more than half a page. Articles were categorised as being anonymous with no journalist name provided or as named with the author of the article provided.

Quality Assessment Measure

Each article was reviewed and graded using the Quality Assessment Tool, which was developed and validated by Robinson *et al.[16]*. The tool assessed different aspects of reporting quality such as generalisability and significance of findings, editorial content, credibility of source, and representativeness of research used. The tool consists of 21 items, and points are awarded or deducted based on whether the article meets the criteria. Items 1-8 and 18-21 are considered essential criteria and for these questions points are deducted if the criteria are not met. Items 9-17 are considered desirable and points are awarded if the criteria are met and zero if the criteria is not met. Articles can receive a maximum of 17 points or minimum of -12 (See Supplemental material). Following grading, articles were categorised based on the quality of reporting with poor quality (scoring < 0), satisfactory (0 – 10), or high quality (> 10)[16].

Statistical analysis

Descriptive statistics were conducted to gain frequencies, mean values and ascertain the spread of data. One-way analysis of variance (ANOVA) with *Post-hoc Bonferroni* correction was used to compare quality of reporting across the 5 newspapers and to determine which factors influenced article quality. Factors considered using this method included article size, food and health categories, day and week of publication. An independent sample t-test was used to compare the quality of reporting by whether the

journalist was named author of the article. Analysis was conducted using StataIC 13 with the level of significance set at P-value of <0.05.

RESULTS

Descriptive Analysis

In total, 141 different articles were published over the 6 week period (see Table 1) in the five newspapers. Five articles on heart disease were excluded, which were initially included, as they focused on statins rather than dietary intake. A mean of 24 articles were published each week and a mean of 4 articles were published each day. *The Daily Mail* had the most publications relating to nutrition and health over the period studied (n = 40). Their articles accounted for 28.4% of the total publications. In contrast, *the Sun* published the fewest articles (n = 20), accounting for only 14.2% of the total publications.

There were 48 named journalists across the 141 articles. These journalists were responsible for publishing 98 (69.5%) of the articles reviewed (table 1). The remaining 43 (30.5%) articles were published anonymously. *The Sun* had the highest number of anonymous publications (n = 8, 40%), closely followed by The Daily Mail (n = 15, 38%). The Daily Express had the lowest number of anonymous publications (n=6, 20%).

The majority of articles were categorised as small (n=87, 61.7%), with an overall mean (SD) column inches of 22.9 (2.1) (table 1). There was a significant difference between the number of column inches' newspapers allocated nutrition and health articles *(p = 0.04). The Daily Express,* had the greatest number of large sized articles (n = 10, 33.3%) and the broadsheet, *The Daily Telegraph,* provided the fewest column inches to nutrition articles *[mean (SD) 11.4 (1.4)]* and had no large sized articles for nutrition.

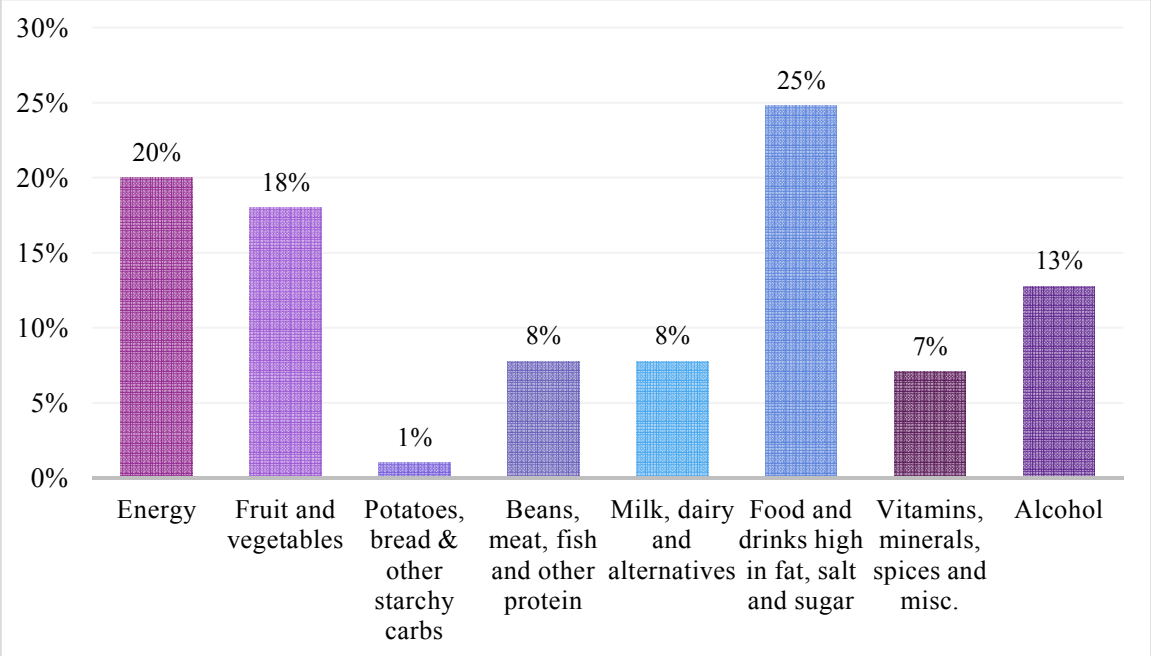
Table 1. *Descriptive analysis for each newspaper*

Newspaper	N	Column inches		Article size (n, %)			Named authors (n, %)
		Mean	(SD)	Small	Medium	Large	
The Sun	20	29.0	(8.3)	14(70%)	0 (0%)	6 (30%)	12 (60%)
The Daily Mirror	23	25.7	(6.4)	15 (65%)	2 (9%)	6 (26%)	17 (74%)
The Daily Telegraph	28	11.4	(1.4)	23 (82%)	5 (18%)	0 (0%)	20 (71%)
The Daily Express	30	29.0	(4.1)	14 (47%)	6 (20%)	10 (33%)	24 (80%)
The Daily Mail	40	21.8	(3.1)	21 (53%)	11 (28%)	8 (20%)	25 (63%)
Total	**141**	**22.9**	**(2.1)**	**87 (62%)**	**24 (17%)**	**30 (21%)**	**98 (70%)**

Note. N = Number of articles; % = percentage

The majority of articles discussed diet and nutrition in relation to their effect on health and wellbeing. Conditions covered most frequently were obesity (n = 35, 25%) cardiovascular disease (n = 34, 24%) and neurological disorders (n = 22, 16%). The main dietary components covered were food and drinks high in fat, salt and/or sugar (n = 35, 25%), energy (n = 28, 20%), fruits and vegetables (n= 25, 18%). (See figure 1).

Figure 1. The proportion of news articles focusing on various aspects of dietary intake in relation to health outcomes.



Quality assessment

The quality of reporting across the newspapers ranged from -9 to 10, with an overall mean (SD) score of 1.76 (5.03). On average, the newspaper publishing the highest quality articles was *The Daily Express* with a mean (SD) score of 2.63 (4.70). *The Sun* had the lowest quality of reporting at -0.55 (5.21), with 45% of articles rated poor quality *(*see table 2*)*. However, there was no significant difference between the quality of reporting observed in each newspaper *(p = 0.19).* In total, 44 (31%) articles were rated poor quality (score < 0) and 97 (69%) were rated satisfactory quality (0-10). There were no high quality articles (> 10).

Table 2. Mean Quality Assessment Tool scores by newspaper, article size and journalist

Newspaper	Overall		Article size						Journalist named			
	Mean	95% CI	Small[a]		Medium[b]		Large[c]		No[d]		Yes[e]	
			Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)
The Sun	-0.55	-2.99 – 1.89	-1.1	5.2	0	0	0.83	5.4	-1.6	5.3	0.2	5.2
The Daily Mirror	2.22	0.27 – 4.16	1.8	4.3	7	0	1.7	5.2	-2.3	2.3	3.8	4.0
The Daily Telegraph	2.54	0.56 – 4.51	1.3	4.8	8	1.9	0	0	-1.0	4.04	3.9	4.9
Daily Express	2.63	0.89 – 4.39	1.5	3.0	3.8	5.0	3.5	6.3	-1.3	4.5	3.6	4.3
The Daily Mail	1.45	-0.24 – 3.14	1.2	5.9	1.7	4.3	1.6	5.3	-1.7	4.9	3.3	4.6
Overall	**1.76**	**0.92 – 2.59**	**1.0***	**4.8**	**4***	**4.6**	**2.1**	**5.5**	**-1.6****	**4.3**	**3.2****	**4.6**

Note. [a]*n = 87.* [b]*n = 24.* [c]*n = 30.* [d]*n = 43.* [e]*n = 98*

**p < 0.05. **p < 0.01*

There was a significant difference in the quality of reporting between weeks ($p < 0.01$). Articles published in week 1 scored significantly lower in quality than articles published in week 2 *($p < 0.01$),* week 3 *($p < 0.01$*), week 5 *($p < 0.01$)* and week 6 *($p < 0.01$).* There was no significant difference in the quality of reporting observed between the other weeks. Day of publication also appeared to influence quality of reporting, with articles published on Thursday's scoring significantly higher in quality than those published on Tuesday's *($p=0.01$).*

There was a significant difference between the quality of reporting observed in articles with journalists named as author and those without ($p < 0.01$). Articles with a named author had higher scores on average *($n = 98$, Mean 3.22, SD 4.6)* than those written anonymously *($n = 43$, Mean -1.58, SD 4.3).* Analysis revealed that there was also a significant difference between the quality of reporting based on the size of the article *($p = 0.03$). Post-hoc* Bonferroni indicated that medium sized articles were significantly higher quality than small articles *($p = 0.03$).* There was no significant difference between the quality of reporting seen in medium and large articles *($p = 0.48$).*

There was a significant difference in the quality of reporting observed across different health categories *($p < 0.01$*). *Post-hoc* Bonferroni analysis revealed that articles focusing on obesity were of significantly lower quality than those about CVD *($p < 0.01$)* (table 3*).* There was no significant difference between the quality of reporting for different food topics *($p = 0.45$).*

Table 3. *Mean Quality Assessment Tool scores by health outcome*

Health category	N	%	Mean	95% CI
Cancers	8	5.7	2.63	-1.18 – 6.43
Cardiovascular health	34	24.1	3.47**	1.58 – 5.36
Diabetes	17	12.1	3.47	1.19 – 5.75
Obesity	35	24.8	-0.91**	-2.21 – 0.38
Neurological disorders	22	15.6	2.14	0.23 – 4.04
Life expectancy	10	7.1	2.1	-0.88 – 5.08
Respiratory, endocrine or reproductive	12	8.5	0	-3.06 – 3.07
Muscular Skeletal	3	2.1	4.67	2.29 - 7.04
Overall	**143**	**100%**	**1.76**	**0.92 – 2.59**

*$p < 0.05$. **$p < 0.01$

Table 4 provides a breakdown of the scores newspapers attained for each of the 21 items. The analysis revealed that 54% of articles ranked negatively for Q1, which meant the article was not based on research or did not cite the journal of publication (or indeed, there wasn't a publication). The majority of articles omitted essential information such as number of participants (Q4), and whether the findings differed from previous research (Q5) [61% and 73% retrospectively]. Furthermore, the majority (90%) of articles did not state whether the results of research were statistically significant (Q11). *The Daily Express* had the most negatively scored articles for Q19, meaning the article had the "potential to cause undue harm or optimism". *The Sun* and *The Daily Express* were most likely to score negatively for Q21, stating a "breakthrough" or "cure" in articles. The majority of articles (70%) quoted a second opinion from a specialist (e.g. health professional, nutritionist, or academic).

Table 4: Breakdown of scores attained for each item in quality assessment tool, by newspaper (% of articles).

Question	The Sun (n = 20)		Daily Mirror (n = 23)		Daily Mail (n=40)		Daily Express (n=30)		Daily Telegraph (n = 28)		Overall (n = 141)	
Criteria 1	**+1**	**-1**	**+1**	**-1**	**+1**	**-1**	**+1**	**-1**	**+1**	**-1**	**+1**	**-1**
Q1	20	80	61	39	37	63	57	43	54	46	**46**	**54**
Q2	35	65	52	48	55	45	80	20	71	29	**60**	**40**
Q3	70	30	78	22	80	20	90	10	82	18	**81**	**19**
Q4	25	75	26	74	43	57	40	60	54	46	**39**	**61**
Q5	15	85	26	74	27	73	33	67	29	71	**27**	**73**
Q6	35	65	43	57	30	70	33	67	36	64	**37**	**63**
Q7	45	55	70	30	77	23	70	30	79	21	**70**	**30**
Q8	75	25	78	22	70	30	70	30	71	29	**72**	**28**
Criteria 2	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**
Q9	10	90	17	83	25	75	40	60	21	79	**24**	**76**
Q10	20	80	17	83	20	80	17	83	18	82	**18**	**82**
Q11	15	85	9	91	5	95	10	90	14	86	**10**	**90**
Q12	0	100	0	100	5	95	13	87	4	96	**5**	**95**
Q13	0	100	0	100	0	100	3	97	4	96	**1**	**99**
Q14	0	100	4	96	5	95	0	100	0	100	**2**	**98**
Q15	15	85	35	65	15	85	10	90	25	75	**19**	**81**
Q16	70	30	78	22	70	30	80	20	50	50	**69**	**31**
Q17	25	75	26	74	15	85	17	83	14	86	**18**	**82**
Criteria 3	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**
Q18	5	95	9	91	3	97	0	100	0	100	**3**	**97**
Q19	20	80	22	78	28	72	37	63	29	71	**28**	**72**
Q20	10	90	13	87	15	85	17	83	11	89	**13**	**87**
Q21	20	80	17	83	10	90	23	77	7	93	**15**	**85**

Note. *Marking criteria: +1 = criteria met; -1 or 0 = failed to meet criteria*

DISCUSSION

This is the first study investigating the quality of a large number of nutrition articles in a range of newspapers, enabling identification of a range of key factors in predicting article quality. The main findings were that nutrition articles printed in any newspaper were generally of poor quality, with smaller articles significantly lower in quality than medium size articles. Articles that were printed anonymously, without a named journalist, were also much lower in quality compared to articles written by a health journalist. In many cases, insufficient or inaccurate information was provided to readers. Worryingly, articles that focused on diet and obesity were of significantly poorer quality than those about other health outcomes such as cardiovascular disease or diabetes. Obesity is currently a major public health issue, affecting a quarter of the UK adult population[17]. This type of poor quality reporting is likely to lead to readers being confused or uninterested in the information provided.

The newspapers reviewed varied in their interest to publish nutrition related articles demonstrated by the variation in number of nutrition articles published in each newspaper. *The Daily Mail* published the most articles, accounting for 28% of the total publications while *The Sun* only published half this number of articles. This finding is consistent with previous research[16] where it was also reported that *the Daily Mail* was the most frequent publisher of nutrition articles. Articles are often published in newspapers if the editors believe it will be of interest to readers and therefore a large number of articles can be seen as a positive sign that readers, that is, the public, are interested in nutrition and health. However, if a newspaper is providing a large number of low quality articles then this could have a negative impact on knowledge and possibly behaviour change.

Journalists responsible for writing nutrition and health related articles have the complex role of translating scientific information to the lay public. It is important that the authors ensure the correct balance between portraying scientific information accurately and making the information understandable. On the other side, journalists must make the story "eye-catching" and "appealing" for the public. However, when it comes to making science more newsworthy, it is not just newspaper journalists that are too blame. A recent content analysis[18] revealed that academic press releases play an influential role in the quality of news articles. Their findings highlighted that many of the exaggerations in media articles stemmed from exaggerations in academic press releases. It is therefore the responsibility of journalists, scientists and academic press offices to work together to publish good quality, accurate news[19].

Articles that are too small to cover many of the main points are more likely to be of lower quality. Furthermore, there were particular newspapers such as *the Daily Telegraph* that were more likely to publish short articles which was also seen in previous analysis[16]. There is no standard or recommendations in terms of column inches that nutrition articles need to meet. However, we would suggest that medium sized articles of length 20 to 34 column inches are needed to be able to successfully provide sufficient context for readers to understand the main points of the research as well as the conditions attached to the research such as generalisability or quality of study design. Previous research has also highlighted that smaller articles tend to lack context and provide only the key findings of research, with limited information about the quality or limitations of the methods[8]. We found that research using a weak epidemiological study design such as a cross-sectional study are given the same weighting as a systematic review of randomised controlled trials when reporting on causality. Similarly, research based on animals/laboratories was at times

presented in a misleading way and generalised the findings to human populations. Newspaper editors could be provided with guidelines on the minimum information that needs to be included in a nutrition article for readers to be able to understand the main points.

Anonymously published articles were also of considerably lower quality than articles where the author's name was provided. Approximately one third of the articles did not have a named journalist attached to them. These were more likely to be written by journalists who are not health journalists and do not write about health regularly. They may know less about health issues and have had little training in this area[20] and therefore is not surprising that the quality was lower. We recommend that nutrition articles only be published by journalists with a background in health and an understanding of scientific research methods. Many journalists may have the perception that it is easier to provide good quality information on obesity than it is on heart disease or diabetes as they are more familiar with the subject. However, our research highlights that this is not the case. Articles about obesity were very poor in terms of quality and this is a particular concern for public health as obesity is a major public health issue in the UK. Many readers rely on information from newspapers and magazines about how to lose weight[21] and it is therefore essential that the quality of this information be improved and consistently presents a clear public health messages[22]. Previous research has highlighted that the mass media can be an effective tool health professionals can utilise as a way to increase public knowledge of aspects of public health such as physical activity[7] and drink driving[23]. However, contradictory information and misrepresentation of emerging nutrition research can lead to public confusion and distrust in the evidence based dietary advice and public health recommendations[13 24]. It is essential steps are made to improve

the quality of nutrition coverage as misinformation can be highly damaging for public health[25 26].

There is no evidence that the quality of reporting of health research has improved over the last 20 years despite repeated calls to curb the alarmist and sensationalist headlines and preliminary research being reported as a breakthrough since 1993[27]. Newspapers want to publish news of interest for their readers but there is some evidence that supports the view that the public do not want poor quality reporting. A study published in 1997[28] stated that 81% of those surveyed said they only wanted to hear about findings once "there is acceptance among nutrition and health professionals". The current situation frequently ignores these views.

There are a number of notable limitations to this research. Data was only collected for a limited period. Therefore, if there are differences in the type and quality of articles published by month or season it is possible that we have not captured a true picture of the quality of nutrition articles. In the previous study by Robinson *et al.[16]* data was collected December to January and therefore articles could have been influenced by Christmas and January dieting. However, we have no information to lead us to believe that there are large differences by season. It is more likely that fluctuations may occur when a nutrition topic of particular interest is covered in the news, which may increase the proportion of larger articles written or the number of articles categorised under a particular health outcome. Perhaps more importantly, most newspapers have reported declines in circulation figures as more people are turning to alternative sources e.g. online news websites, blogs[29] although 95% of adults do use at least one source of news. The most popular newspapers that we included in our survey all have an online presence that may ultimately be the most

common source of news in the future. Many of the articles will have been published on the online version but we did not explore this. Although printed newspapers are still an important source of news, future research should take into account different sources of news not just printed newspapers.

We make a number of recommendations based on our findings; for future research and to improve the quality of nutrition articles in newspapers. It is clear that journalists should have adequate training in issues related to scientific methods and health if they are publishing articles in this area. The *Science Media Centre* is well based to provide this and does have support on various health issues but offers little in the form of guidance to journalists publishing about nutrition. Academics, health professionals and university press officers are also key in this process and could contribute to this training. However, it is clear that all parties need to work together to ensure that high quality research gets priority when choosing articles for publication. Newspaper editors should consider publishing a smaller number of higher quality articles on nutritional issues, responding to public demand in terms of quality and quantity.

Contributorship statement

CE provided the original idea for the survey, wrote the first draft of the discussion and contributed to first and subsequent drafts of the manuscript. AK checked and analysed the data, wrote the first draft of the manuscript and contributed to all subsequent drafts. NA contributed to the design of the survey, collected the data, contributed to the analysis of the data and the final draft of the manuscript. NJ contributed to the analysis of the data and to the final draft of the manuscript.

Competing interests

We have read and understood the BMJ Open policy on declaration of interests and declare that we have no competing interests.

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Data sharing statement

No part of the dataset is available.

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Supplemental material: Quality assessment instrument used to assess the quality of reporting (Robinson *et al.,* 2013).

Appendix 1–Full version of the quality assessment instrument for health news. <online only>

Criteria	Description	Score	
		Yes	No
1	Does the article cite a journal?[a]	+1	-1
2	Does the article cite an author from the journal paper?[a]	+1	-1
3	Does the article cite an affiliated organization?	+1	-1
4	Does the article state the number of subjects?	+1	-1
5	Does the article state whether the study differs from previous research?	+1	-1
6	Does the article compare statistics, are they misused or misrepresented?	+1	-1
7	Does the article give adequate background?[a]	+1	-1
8	Is the headline a fair reflection of the article and journal paper?	+1	-1
9	Does the article state whether the findings are preliminary or conclusive?	+1	-
10	Does the article state whether the study differs from mainstream science?	+1	-
11	Does the article state whether the findings are statistically significant?	+1	-
12	Does the article report the absolute risk?	+1	-
13	Does the article report the relative risk?	+1	-
14	Does the article explore the safety of the intervention?[a]	+1	-
15	Does the article explore any caveats?[a]	+1	-
16	Does the article quote a specialist opinion?[a]	+1	-
17	Is the study representative of the UK population, or does the article state that the results cannot be generalized?	+1	-
18	Does the article mention data that was not in the cited article?	-1	-
19	Does the article have the potential to cause undue harm or optimism?[a]	-1	-
20	Does the article generalize from laboratory-based/animal studies to humans without explicitly stating so?	-1	-
21	Does the article state that a 'breakthrough' has been made, or a 'cure' been found?	-1	-

For the first eight criteria, articles can be awarded either a positive or negative score. For Criteria 9–17, a positive score is given if the criteria are met, and for Criteria 18–21, a negative score is awarded if the criteria are met.

[a]Criteria included in revised scale post-item reduction.

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Quality assessment of nutrition coverage in the media: A 6 week survey of five popular UK newspapers

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ABSTRACT

Objectives: This study aims to investigate the quality of nutrition articles in the top five national daily newspapers in the UK and to identify important predictors of quality both between and within newspaper title.

Setting: Newspapers are a primary source of nutrition information for the public.

Design: Newspaper articles were collected on 6 days of the week (excluding Sunday) for 6 weeks in summer 2014.

Outcome measures: A validated Quality Assessment Tool was used to assess each article, with minimum possible score of -12 and maximum score of 17. Newspapers were checked in duplicate for relevant articles. Scores and predictors were analysed individually using one-way ANOVA or independent t-tests and in a multiple regression model with quality score as the outcome measure.

Results: A total of 141 nutrition articles were included across the 5 newspapers. The mean (SD) quality score was 1.8 (5.0) indicating that articles were generally of poor quality. There was no substantial variation in quality of reporting between newspapers once other factors such as day of the week published, article size, anonymous publishing, health outcome and aspect of diet covered were taken into account. Particularly low scores were obtained for; anonymously published articles with mean (SD) quality score of -1.6 (4.3) compared with 3.2 (4.6) for named articles ($p<0.01$); articles that focused on obesity with mean (SD) of -0.9 (3.9) compared with 2.6 (5.1) for remaining articles *($p<0.01$)* and smaller articles ($p<0.01$).

Conclusions: This study confirms that the public are regularly exposed to poor quality information in newspapers about what to eat to promote health, particularly articles covering obesity. Journalists, researchers, university press officers and scientific journals need to work together more closely to ensure clear, consistent nutrition messages are engagingly communicated to the public.

ARTICLE SUMMARY

- A large number of nutrition articles from newspapers were analysed for article quality using a validated quality assessment tool
- Key predictors for article quality were identified when taking into account other factors
- Additional sources of media such as online and social media were not included in the analysis
- Newspaper articles were collected over 6 weeks but longer time periods may be needed to explain some of the differences in article quality

INTRODUCTION

Chronic conditions such as obesity, cardiovascular disease, type II diabetes and stroke are leading causes of death, accounting for 86% of total deaths in the UK[1]. As a result of lifestyle factors such as poor diet, physical inactivity, and excess weight playing key roles in the development of these chronic conditions[2 3], 33,000 deaths each year could be avoided if the UK dietary recommendations were met[4]. Therefore, raising knowledge and awareness of dietary guidelines in an effort to educate and encourage the public to make a conscious decision about their dietary intake could help to significantly improve the health of the population and reduce the incidence of these conditions[5].

The media is comprised of the internet, radio, television, smartphones, and printed newspapers and media communications are shown to have an influential effect on the public's knowledge and awareness of health issues, which has the potential to promote positive behaviour change[6 7]. Only a decade ago, tabloid and broadsheet newspapers were the primary source of health based information[8], however news from social media sources such as Facebook and Twitter are now popular. Nevertheless, despite a dramatic increase in the use of online media[9], printed newspapers remain an efficient way of providing the public with essential information[10 11]. Therefore, it is likely that good quality reporting by health correspondents in printed newspapers has the potential to be more successful in raising awareness of health related issues that would then allow the public to make informed decisions[11].

Previous research has shown that nutrition coverage has often been sensationalist, with the headlines not accurately reflecting the scientific research[12] and based on reporting preliminary research as a "breakthrough"[13]. The media have been criticised for their classification of "newsworthy" stories[13] and one study reported that 72% of articles were based on low quality scientific evidence[10]. It is common to present contradictory messages or an unbalanced view about health and nutrition in many media articles [14-16]. On the other hand, newspapers do not exist to provide a free public health service to the public but to provide newsworthy articles[17].

A review of the quality of 160 health based articles in eight UK newspapers over 4 weeks revealed significant differences in the quality of reporting between newspapers[18] with *The Times* publishing the highest quality articles and *The Sun* the lowest. Their findings highlighted aspects of an article related to editorial policy that affected the quality of reporting such as article length, journalist, and credibility of source however they did not explore how these predictors of quality varied by paper or interacted with each other. Therefore, the main aims of this study were to use the validated quality assessment tool by Robinson et al[18] to assess the quality of nutrition coverage in five of the highest circulating printed newspapers and to determine the most important predictors of article quality in order to explain differences in quality between papers. We also made recommendations to improve the quality of future nutrition and health reporting in the media.

METHODS

Data collection

Five of the highest six circulating tabloid and broadsheet national newspapers in the UK were examined in the summer of 2014. Four tabloid newspapers (*The Sun*, *The Daily Mirror*, *The Daily Mail* and *The Daily Express*) and one broadsheet, (*The Daily Telegraph*) were included in this study. We omitted the Daily Standard from the included list, as it is not available outside London. Both tabloid and broadsheet newspapers were included to understand whether there were any differences in predictors of quality of the nutrition coverage in these forms of media.

Printed editions of the five newspapers were collected on 6 days of the week (Monday to Saturday) for 6 weeks from 30 June 2014 to 9 August 2014. Sunday was excluded from the data collection as a pilot study revealed repetition of nutrition/health articles from previous days. Each printed newspaper was scanned by a researcher in its entirety. Articles covering an aspect of nutrition (as an exposure) and an aspect of human health (as a health outcome) were identified and extracted for inclusion in this study. Articles were excluded if a) they covered nutrition but without a related health outcome (for example the use of cucumber as a beauty therapy); or b) they covered a health outcome such as heart disease

without discussing diet. Articles from opinion columns were also excluded. This process was carried out in duplicate by a second researcher and the selected articles were reviewed by a third nutritionist. Articles that did not adequately meet inclusion criteria were excluded.

Where sufficient information was provided, original research was located using PubMed and other online databases. Articles with insufficient information to locate original research or not based on published research were not excluded. Each article was coded with a unique ID number. Descriptive data such as, the newspaper title, article size, date and day of publication and journalist's name, were extracted for each article. Articles were categorised into aspect of diet and health outcome covered in the publication. Dietary components were broadly categorised according to *The Eatwell guide*[19] but with high fat and high sugar foods separated into different food categories as these are usually covered separately in the media.

The size of the article in column inches was measured using a standard method (column inches high x number of columns). Articles were then categorised into either small (≤ 19.9 inches), medium (20 – 34 inches) or large (≥ 35 inches) based on space allocated to article. The cut-off points for these categories were based on the average column inches for less than half page, half a page and more than half a page. Articles were categorised as being anonymous with no journalist name provided or as named if the author of the article was provided (known as a by-line).

Quality Assessment Measure

Each article was reviewed and graded using a validated Quality Assessment Tool[18]. The tool assessed different aspects of reporting quality such as generalisability and significance of findings, editorial content, credibility of source, and representativeness of research used. The tool consists of 21 items, and points were awarded or deducted based on whether the article met the criteria. Items 1-8 and 18-21 were considered essential criteria, for these questions, points were deducted if the criteria were not met. Items 9-17 were considered desirable and points were awarded if the criteria were met and zero if the

criteria was not met (see the complete list of questions published by Robinson et al[18]). Articles could receive a maximum of 17 points or minimum of -12. Following grading, articles were categorised based on the quality of reporting with poor quality (scoring < 0), satisfactory (0 – 10), or high quality (> 10)[18].

Statistical analysis

Descriptive statistics were conducted to obtain frequencies, mean values and to determine the spread of data for newspaper title, quality score and six predictor variables namely, week of publication, day of publication, type of health outcome, type of food category, size of article and whether anonymously written. One-way analysis of variance (ANOVA) with *Post-hoc Bonferroni* correction was used to compare quality of reporting across the five newspapers and to determine which of the six factors listed above individually influenced article quality. An independent sample t-test was used to compare the quality of reporting by whether the journalist was named author of the article and by whether the article covered obesity or not. A multiple regression model with all six predictor factors and paper title included in the model was used to determine differences in quality score between newspaper title when adjusted for all other predictors listed above and thereby determine which were the key predictors of quality. Differences between newspaper title for each of the 21 questions in the quality assessment tool were tested using Chi-Squared tests. Analysis was conducted using StataIC 13 with the level of significance set at P-value of <0.05.

RESULTS

Descriptive Analysis

In total, 141 different articles were published over the 6 week period (see Table 1) in the five newspapers. Five articles on heart disease were excluded, which were initially included, as they focussed on statins rather than dietary intake. A mean of 24 articles were published each week and a mean of four articles were published each day. *The Daily Mail* had the most publications relating to nutrition and health over the period studied (n = 40). Their articles accounted for 28.4% of the total

publications. In contrast, *the Sun* published the fewest articles (n = 20), accounting for only 14.2% of the total publications. Papers varied in the proportion of small articles and anonymous articles (see table 1).

Table 1. *Descriptive analysis for each newspaper and all articles including information on numbers (N) and percent (%) of articles in each paper, mean and standard deviation (SD) of column inches for each article, N and % of small, medium and large articles and N and % of articles provided with a named author/journalist.*

Newspaper	N (%)	Quality score		Column inches		By article size N (%)			Named journalist N (%)
		Mean	(95% CI)	Mean	(SD)	Small	Medium	Large	
The Sun	20 (14)	-0.6	-3.0 – 1.9	29.0	(8.3)	14(70)	0 (0)	6 (30)	12 (60)
The Daily Mirror	23 (16)	2.2	0.3 – 4.2	25.7	(6.4)	15 (65)	2 (9)	6 (26)	17 (74)
The Daily Mail	40 (28)	1.5	-0.2 – 3.1	21.8	(3.1)	21 (53)	11 (28)	8 (20)	25 (63)
The Daily Express	30 (21)	2.6	0.9 – 4.4	29.0	(4.1)	14 (47)	6 (20)	10 (33)	24 (80)
The Daily Telegraph	28 (20)	2.5	0.6 – 4.5	11.4	(1.4)	23 (82)	5 (18)	0 (0)	20 (71)
Total	**141 (100%)**	**1.8**	**0.9 – 2.6**	**22.9**	**(2.1)**	**87 (62%)**	**24 (17%)**	**30 (21%)**	**98 (70%)**

Quality assessment

The quality scores across the newspapers ranged from -9 to 10, with an overall mean (SD) score of 1.76 (5.03). On average, the newspaper publishing the highest quality articles was *The Daily Express* with a mean (SD) score of 2.63 (4.7). *The Sun* had the lowest quality of reporting at -0.55 (5.21), with 45% of articles rated poor quality *(*see table 1*)*. In total, 44 (31.2%) articles were rated poor quality (score < 0) and 97 (68.8%) were rated satisfactory quality (0-10). There were no high quality articles (score > 10). There was a significant difference between the quality of reporting observed between some of the newspapers (p values provided). Using The Sun as a reference category, the Daily Mail (p=0.15) and the Daily Mirror (p=0.07) had a similar quality score whereas the Daily Telegraph (p=0.04) and the Daily Express (0.03) had significantly higher scores.

There was a significant difference in the quality of reporting between some weeks. Mean scores for week 1 to 6 varied and were -3.4, 3.0, 3.0, 0.7, 2.5 and 3.4 consecutively. Articles published in week 1 scored significantly lower in quality than articles published in weeks 2-6 *(p < 0.01)* although there were no significant differences in the quality of reporting observed between the other weeks. Day of publication also appeared to be important. Mean scores for Monday to Saturday were 1.2, -0.1, 1.6, 4.4, 3.4 and 1.1 respectively. Articles published on Thursdays scored significantly higher in quality than those published on Tuesdays *(p=0.01)*.

There were 48 named journalists across the 141 articles. These journalists were responsible for publishing 98 (69.5%) of the articles reviewed. The remaining 43 (30.5%) articles were published anonymously (table 1). *The Sun* had the highest number of anonymous publications (n = 8, 40.0%), followed by The Daily Mail (n = 15, 37.5%). Articles with a

named author had higher scores on average *(Mean 3.22, SD 4.6)* than those written anonymously *(Mean -1.58, SD 4.3*). There was a significant difference between the quality of reporting observed in articles with journalists named as author and those without ($p < 0.01$).

The majority of articles were categorised as small (n=87, 61.7%), with an overall mean (SD) column inches of 22.9 (2.1) (table 1). There was a significant difference between the number of column inches that newspapers allocated to nutrition and health articles *($p = 0.04$). The Daily Express,* had the greatest number of large sized articles (n = 10, 33.3%) and the broadsheet, *The Daily Telegraph,* provided the fewest column inches to nutrition articles *[mean (SD) 11.4 (1.4)]* and had no large sized articles for nutrition. Small articles had a mean (SD) quality score of 1.0 (4.8) while medium and large articles had scores of 4 (4.6) and 2.1 (5.5) respectively. Testing revealed that there was a significant difference between the quality of reporting based on the size of the article *($p = 0.03$).* Medium sized articles were significantly higher quality than small articles *($p = 0.03$)* however there was no significant difference between the quality of reporting seen in medium and large articles *($p = 0.48$).*

The majority of articles discussed diet and nutrition in relation to their effect on health and wellbeing. Conditions covered most often were obesity (n = 35, 24.8%) cardiovascular disease (n = 34, 24.1%) and neurological disorders (n = 22, 15.6%). The main dietary components covered were food and drinks high in fat, salt and/or sugar (n = 30, 21.3%), energy (n = 27, 19.1%), fruits and vegetables (n= 25, 17.7%). There was a significant difference in the quality of reporting observed across different health categories *($p < 0.01$)*. Articles focusing on obesity were of significantly lower quality than those reporting on

CVD *(p < 0.01)* (table 2). There was no substantial difference between the quality of reporting for different food topics *(p = 0.45)*. Articles that focused on obesity had a mean (SD) quality score of -0.9 (3.9) compared with 2.6 (5.1) for remaining articles *(p<0.01)*.

Table 2. *Number, percent, mean scores of article quality and 95% confidence interval (95% CI) for each of the eight different categories of food type and 8 different categories of health outcome. A higher score indicates a higher quality newspaper article*

Category	N	%	Mean score	95% CI
Food Categories				
Calories	27	19	1.0	-0.7 to 2.7
Alcohol	18	13	2.7	0.6 to 4.8
Fruit and vegetables	25	18	1.8	-.8 to 4.3
High fat & processed foods	21	15	0.6	-1.7 to 2.8
Protein rich foods	8	6	4.0	1.3 to 6.7
Dairy foods	13	9	1.5	-1.7 to 4.6
Sugary drinks & confectionery	9	6	1.8	-2.5 to 6.1
Other (vitamins & ingredients)	20	14	2.5	-.2 to 5.1
Health Categories				
Cancers	8	6	2.6	-1.2 to 6.4
Cardiovascular health	34	24	3.5	1.6 to 5.4
Diabetes	17	12	3.5	1.2 to 5.8
Obesity	35	25	-0.9	-2.2 to 0.4
Neurological disorders	22	16	2.1	0.2 to 4.0
Life expectancy	10	7	2.1	-0.9 to 5.1
Respiratory, endocrine or reproductive	12	9	0	-3.1 to 3.1
Muscular Skeletal	3	2	4.7	2.3 to 7.0
Overall	**141**	**100%**	**1.8**	**0.9 to 2.6**

We investigated whether the predictors of article quality explained differences in quality between different newspapers and whether the coefficients were attenuated in a regression model when each predictor was adjusted for the remaining predictors. Using the category

with the lowest quality score as the reference category, there were no appreciable difference in the quality of articles in different newspapers when the six identified predictor variables (week, day, food type, health category, article size and named journalist) were taken into account (see table 3). Furthermore, the majority of the predictor variables remained significant when adjusted for other variables. Articles in week 1 were lower in quality as were articles published on a Monday, Tuesday and Saturday. Articles on obesity were lower in quality as were small articles and those written without a named journalist. Although there were correlations between variables these did not fully explain the differences in quality score. For example, articles on obesity were common on Monday (Percent of articles on obesity Monday to Saturday was 48%, 29%, 16%, 12%, 33% and 0% respectively) but day of the week and obesity both independently contributed to the quality score. In addition, obesity articles were more likely to be anonymous (63%) than any other health category compared with the overall mean of 70%.

Table 3: Predictors of quality score for different factors including paper title, week, day, food category, health category, named journalist and article size in column inches..

Factors predicting article quality score	n	Co-efficient	95% CI co-efficient	P value
Paper title: Reference category is The Sun	**20**			
The Daily Mirror	23	0.5	-2.1 to 3.2	0.69
The Daily Mail	40	1.1	-1.2 to 3.3	0.35
The Daily Express	30	1.5	-0.9 to 4.0	0.23
The Daily Telegraph	28	1.9	-0.6 to 4.4	0.13
Week: reference category is week 1	**19**			
Week 2	27	6.6	4.0 to 9.3	<0.01
Week 3	25	4.5	1.7 to 7.3	<0.01
Week 4	23	4.8	2.0 to 7.6	<0.01

Week 5	22	5.3	2.5 to 8.0	<0.01
Week 6	25	6.8	3.9 to 9.7	<0.01
Day: reference category is Tuesday	**35**			
Monday	27	1.9	-0.4 to 4.3	0.11
Wednesday	25	3.7	1.3 to 6.1	<0.01
Thursday	25	4.6	2.1 to 7.2	<0.01
Friday	15	3.5	0.8 to 6.3	0.01
Saturday	14	-1.8	-4.6 to 1.0	0.21
Food: reference category is High fat foods	**21**			
Energy (Calories)	27	2.5	-0.3 to 5.2	0.08
Alcohol	18	2.7	-0.2 to 5.5	0.07
Fruit and vegetables	25	2.0	-0.7 to 4.6	0.14
Protein foods	8	4.3	0.8 to 7.9	0.02
Dairy foods	13	2.8	-0.1 to 5.8	0.06
Sugary drinks and confectionery	9	4.4	0.5 to 8.3	0.03
Other (vitamins, ingredients)	20	1.2	-1.5 to 3.9	0.39
Health: reference category is obesity	**35**			
Cancer	8	6.2	2.7 to 9.8	<0.01
CVD	34	3.7	1.3 to 6.0	<0.01
Type 2 Diabetes	17	2.3	-0.3 to 4.8	0.09
Neurological disorders	22	2.6	-0.1 to 5.2	0.06
Life Expectancy	10	1.8	-1.3 to 5.0	0.26
Other (respiratory, reproductive)	12	1.2	-1.8 to 4.1	0.43
Muscular-skeletal	3	2.4	-3.9 to 8.7	0.45
Named journalist: reference category is No	**43**			
Yes, named journalist	98	2.5	0.8 to 4.3	<0.01
Article Size:				

Table 3. Percentage of articles meeting and not meeting the criteria for each of the 21 items in the validated quality assessment tool. Results presented for individual papers and for all papers combined. For each item met a value of +1 (criteria 1 and 2) or zero (criteria 3) is achieved and for each item not met either a zero (criteria 2) or -1 (criteria 1 and 3) is achieved. P values are from chi Squared test to determine differences in newspapers meeting criteria for each question.

Increase for 10 column inches	141	0.5	0.2 to 0.9	<0.01

We tested which of the 21 questions on quality responses varied substantially between newspapers. Table 4 provides a breakdown of the scores for each of the 21 items for individual newspapers. The analysis revealed that 54% of articles ranked negatively for Q1, which meant the article was not based on published research or did not cite the journal of publication and 40% did not provide an author name. The newspapers differed significantly in what proportion of their articles met these two criteria. The majority of articles omitted essential information such as number of participants (Q4), and whether the findings differed from previous research (Q5) [61% and 73% retrospectively] but these results did not vary substantially by newspaper. Furthermore, the majority (90%) of articles did not state whether the results of research were statistically significant (Q11). *The Daily Express* had the most negatively scored articles for Q19, meaning the article had the "potential to cause undue harm or optimism". *The Sun* and *The Daily Express* were most likely to score negatively for Q21, stating a "breakthrough" or "cure" in articles. The majority of articles (70%) quoted a second opinion from a specialist (e.g. health professional, nutritionist, or academic).

Question	The Sun (n = 20)		Daily Mirror (n = 23)		Daily Mail (n=40)		Daily Express (n=30)		Daily Telegraph (n = 28)		All papers (n = 141)		P values
Criteria 1	**+1**	**-1**	**+1**	**-1**	**+1**	**-1**	**+1**	**-1**	**+1**	**-1**	**+1**	**-1**	
Q1	20	80	61	39	37	63	57	43	54	46	46	54	0.03
Q2	35	65	52	48	55	45	80	20	71	29	60	40	0.01
Q3	70	30	78	22	80	20	90	10	82	18	81	19	0.5
Q4	25	75	26	74	43	57	40	60	54	46	39	61	0.2
Q5	15	85	26	74	27	73	33	67	29	71	27	73	0.7
Q6	35	65	43	57	30	70	33	67	36	64	37	63	0.3
Q7	45	55	70	30	77	23	70	30	79	21	70	30	0.09
Q8	75	25	78	22	70	30	70	30	71	29	72	28	0.95
Criteria 2	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**	
Q9	10	90	17	83	25	75	40	60	21	79	24	76	0.14
Q10	20	80	17	83	20	80	17	83	18	82	18	82	1.0
Q11	15	85	9	91	5	95	10	90	14	86	10	90	0.68
Q12	0	100	0	100	5	95	13	87	4	96	5	95	0.15
Q13	0	100	0	100	0	100	3	97	4	96	1	99	0.57
Q14	0	100	4	96	5	95	0	100	0	100	2	98	0.43
Q15	15	85	35	65	15	85	10	90	25	75	19	81	0.16
Q16	70	30	78	22	70	30	80	20	50	50	69	31	0.12
Q17	25	75	26	74	15	85	17	83	14	86	18	82	0.71
Criteria 3	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**	
Q18	5	95	9	91	3	97	0	100	0	100	3	97	0.30
Q19	20	80	22	78	28	72	37	63	29	71	28	72	0.70
Q20	10	90	13	87	15	85	17	83	11	89	13	87	0.95
Q21	20	80	17	83	10	90	23	77	7	93	15	85	0.37

257

DISCUSSION

This is the first study that explains differences in article quality between newspapers. The main findings were that differences in quality of articles existed between papers but these differences were largely explained by differences related to editorial policy. Articles with the lowest quality scores were more likely to; be published on Monday, Tuesday and Saturday, be smaller in size, written anonymously and covering obesity or type 2 diabetes. The finding for articles on obesity were particularly worrying. Journalists may perceive that it is easier to write a news article on obesity than on heart disease as they feel more familiar with the subject. Poor quality reporting can lead to readers being confused or uninterested in the poor information provided[20]; a serious concern given that obesity affects a quarter of the UK adult population[21] and many readers may rely on information from newspapers about how to lose weight[22].

Journalists have the complex role of translating scientific information to the lay public and it is important that the authors have sufficient understanding to ensure the correct balance between portraying scientific information accurately and making the information clear and readable. On the other hand, journalists must make the story "eye-catching" and "appealing" for the public, which can lead to nutrition articles containing sensationalist reporting, alarmist headlines or contradictory information, resulting in confusion or distrust of dietary recommendations[14 23]. Journalists are in a position to shape social norms and attitudes through their choice of topics to publish and therefore may influence understanding of and appetite for particular stories but ultimately, the role of journalists is to provide news that is interesting and sells newspapers and not to act as a public health service to the masses. Of the five newspapers reviewed, *s*ome papers published more nutrition articles than others a finding which is consistent with previous research[18].

However, it may be more beneficial to the public to have fewer higher quality articles rather than many articles of low quality. Articles may be published in newspapers if the editors believe it will be of interest to readers and therefore a large number of articles can be seen as a positive sign that readers (the public) are interested in nutrition and health. On the other hand, the public do not want poor quality reporting. One study reported that more than three quarters (81%) of those surveyed said they only wanted to hear about findings once "there is acceptance among nutrition and health professionals"[24]. The current situation needs to take these views into account. We did not collect relevant information to determine why quality of articles varied by day but it could potentially be due to differences in amount of time journalists spend writing articles with less time to spend on articles earlier in the week and more time on Thursdays and Fridays.

University press officers, researchers and scientific journals also have a key part to play in improving the quality of research reported in the media. A content analysis[25] revealed that academic press releases play an influential role in the quality of news articles but highlighted that many of the exaggerations of media articles stemmed from exaggerations in academic press releases. Nevertheless, the best quality newspaper articles are based on scientific research (usually based in a university) that is published in a scientific journal rather than unpublished research promoted by PR agencies. Improving the quality of reporting in the news perhaps lies firstly with universities and scientific journals providing easier to understand information that can be understood by a non-specialist audience. Scientific journals may prefer to disseminate press releases on some days more often than others which could contribute to the differences by day of the week. Some newspapers were more likely to report on studies that were not from scientific journals, and therefore

one recommendation is to encourage all newspapers to increase the proportion of articles based on published studies.

Previous research has highlighted that the mass media can be an effective tool health professionals can utilise as a way to increase public knowledge of aspects of public health such as physical activity[6 7] or drink-driving[26] and therefore it is beneficial for scientists to work with the media more closely to increase the proportion of high quality articles. The best quality articles were more likely to have certain attributes. They were large enough to cover many of the main points, a similar finding to previous research[10 18]. We would suggest that medium sized articles of length 20 to 34 column inches are needed to successfully provide sufficient context for readers to understand the main points of the research, the conditions attached to the research and the quality of the study design. Higher quality articles were also more likely to be written by a named journalist (with a by-line), often with a declared interest in health however, a third had no name provided. It has previously been suggested that the un-named author may know less about health issues and have had little training in this area[27] however, this is not necessarily true. Health journalists could be more likely to publish articles without a by-line due to differences in editorial policy between newspapers. Articles that have come from press releases may be more likely not to have a by-line and therefore we support more transparency on the source of the information and recommend that more nutrition articles are published by a trained health journalist. Training for journalists is available in the UK such as that provided at the Science Media Centre in London; although little is offered on health and nutrition and the Centre receives corporate funding which may mean it is not neutral. We recommend more rigorous training of journalists in scientific study design and more dialogue between journalists and scientists to improve the choice of studies covered in the news. A recent

review of media quality in Australia concluded that although quality of news media was low, it had recently improved with benefits and harms more accurately provided. This was mainly limited to online news articles[28] but indicates that progress can be made. This will only be achieved if journalists, scientists and academic press offices work together as has previously been highlighted[29].

There are a number of notable limitations to this research. Data was only collected for a limited period from a limited number of papers. Therefore, if there are differences in the type and quality of articles published by paper or by month or season it is possible that we have not captured a true picture of the quality of nutrition articles. It is likely that some newspapers that we have not included are different in format and editorial policy and vary in the quality of their nutrition related articles. It is also likely that fluctuations may occur when a nutrition topic of particular interest is covered in the news which may increase the proportion of larger articles written or the number of articles categorised under a particular health outcome. Importantly, most newspapers have reported declines in circulation figures as more people are turning to alternative sources e.g. online news websites and blogs[30], although the newspapers that we included in our survey (mostly tabloids) did also have an online presence. Many additional articles will have been published on the online version but we did not explore this. Although printed newspapers are still an important source of news, future research should take into account a wider range of sources of news not just printed newspapers. Some of the methods used to measure article attributes do not have universally agreed standards, for example methods for measuring article size. These methods are prone to measurement error and could be improved and validated in future.

It was highlighted in the 1990s[31] that health research was often misrepresented and preliminary research reported as a breakthrough. These findings are mirrored in our study, indicating that despite steps being taken to improve the situation, there has been little improvement to the quality of reporting nearly 30 years later. It is therefore essential that further measures are made to improve the quality of nutrition coverage and minimise the damage to public health[32 33 34]. Firstly, we propose that journalists have adequate training in issues related to scientific methods and health and secondly, newspaper editors consider publishing a smaller number of higher quality articles based on studies published in scientific journals. Thirdly, researchers, health professionals, university and journal press officers are key and could assist in providing clear information following a standard format to media sources as well as support with training.

Finally, all parties need to work together to ensure that nutrition coverage and health messages published for the public are both clear and informative as well as interesting and exciting. Establishing common ground between stake-holders is central to improvement.

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Quality assessment of nutrition coverage in the media: A 6 week survey of five popular UK newspapers

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ABSTRACT

Objectives: This study aims to investigate the quality of nutrition articles in the top five national daily newspapers in the UK and to identify important predictors of quality both between and within newspaper title.

Setting: Newspapers are a primary source of nutrition information for the public.

Design: Newspaper articles were collected on 6 days of the week (excluding Sunday) for 6 weeks in summer 2014. Predictors included food type and health outcome, size of article, whether or not the journalist was named and day of the week.

Outcome measures: A validated Quality Assessment Tool was used to assess each article, with a minimum possible score of -12 and a maximum score of 17. Newspapers were independently checked in duplicate for relevant articles. The association of predictors on quality scores were analysed individually and then combined using regression models with quality score as the outcome measure.

Results: A total of 141 nutrition articles were included across the 5 newspapers over 6 weeks. The mean (95% CI) quality score was 1.8 (0.9 to 2.6) indicating that articles were generally of poor quality. There was no substantial variation in quality of reporting between newspapers once other factors such as article size, anonymous publishing, health outcome, aspect of diet covered and day of the week were taken into account. Particularly low quality scores were obtained for; anonymously published articles with no named journalist, smaller articles and articles that focussed on obesity. These factors explained 43% of variation in article quality score.

Conclusions: The general public are regularly exposed to poor quality information in newspapers about what to eat to promote health, particularly articles covering obesity. Journalists, researchers, university press officers and scientific journals need to work together more closely to ensure clear, consistent nutrition messages are communicated to the public in an engaging way.

ARTICLE SUMMARY

- A large number of nutrition articles from newspapers were analysed for article quality using a validated Quality Assessment Tool
- Key predictors for article quality were identified and explained nearly half of the variation in quality score
- Additional sources of media such as online and social media were not included in the analysis
- Newspaper articles were collected over 6 weeks but longer time periods may be needed to explain some of the differences in article quality

INTRODUCTION

Chronic conditions such as obesity, cardiovascular disease (CVD), type II diabetes and stroke are leading causes of death, accounting for 86% of total deaths in the UK[1]. As a result of lifestyle factors such as poor diet, physical inactivity, and excess weight playing key roles in the development of these chronic conditions[2 3], 33,000 deaths each year could be avoided if the UK dietary recommendations were met[4]. Therefore, raising knowledge and awareness of dietary guidelines in an effort to educate and encourage the public to make a conscious decision about their dietary intake could help to significantly improve the health of the population and reduce the incidence of these conditions[5].

The media is comprised of the internet, radio, television, smartphones, and printed newspapers and media communications, many of which have been shown to have an influential effect on the public's knowledge and awareness of health issues, which has the potential to promote positive behaviour change[6 7]. Only a decade ago, tabloid and broadsheet newspapers were the primary source of health based information[8], however news from social media sources such as Facebook and Twitter are now popular. Nevertheless, despite a dramatic increase in the use of online media[9], printed newspapers remain an efficient way of providing the public with essential information[10 11]. Therefore, it is likely that good quality reporting by health correspondents in printed newspapers has the potential to be more successful in raising awareness of health related issues that would then allow the public to make informed decisions[11].

Previous research has shown that nutrition coverage has often been sensationalist, with the headlines not accurately reflecting the scientific research[12] and based on reporting preliminary research as a "breakthrough"[13]. The media have been criticised for their classification of "newsworthy" stories[13] and one study reported that 72% of articles were based on low quality scientific evidence[10]. It is common to present contradictory messages or an unbalanced view about health and nutrition in many media articles[14-16]. On the other hand, newspapers do not exist to provide a free public health service to the public but to provide newsworthy articles[17].

A review of the quality of 160 health based articles (although not necessarily nutrition related articles) in eight UK newspapers over 4 weeks revealed significant differences in the quality of reporting between newspapers[18] with *The Times* publishing the highest quality articles and *The Sun* the lowest. Their findings highlighted aspects of an article related to editorial policy that affected the quality of reporting such as article length, journalist, and credibility of source; however they did not explore how these predictors of quality explained variation in quality by paper type or whether they interacted with each other. Therefore, the main aims of this study were to use the existing validated quality assessment tool by Robinson et al[18] to assess the quality of nutrition coverage in particular in five of the highest circulating printed newspapers and to determine the most important predictors of article quality to explain any differences in article quality between papers. We also made recommendations to improve the quality of future nutrition and health reporting in the media.

METHODS

Data collection

Five of the highest six circulating tabloid and broadsheet national newspapers in the UK were examined in the summer of 2014. Four tabloid newspapers (*The Sun*, *The Daily Mirror*, *The Daily Mail* and *The Daily Express*) and one broadsheet, (*The Daily Telegraph*) were included in this study. We omitted the Daily Standard from the included list, as it is not available outside London. Both tabloid and broadsheet newspapers were included to understand whether there were any differences in predictors of quality of the nutrition coverage in these forms of media. Audiences vary between the two types of newspaper with tabloids generally targeting audience with a lower socio-economic background[19].

Printed editions of the five newspapers were collected on 6 days of the week (Monday to Saturday) for 6 weeks from 30 June 2014 to 9 August 2014. Sunday was excluded from the data collection as a pilot study revealed repetition of nutrition/health articles from previous days. Each printed newspaper was

scanned by a researcher in its entirety. Articles covering an aspect of nutrition (as an exposure) and an aspect of human health (as a health outcome) were identified and extracted for inclusion in this study. Articles were excluded if a) they covered nutrition but without a related health outcome (for example the use of cucumber as a beauty therapy); or b) they covered a health outcome such as heart disease without discussing diet. Articles from opinion columns were also excluded. This process was carried out in duplicate and independently by a second researcher and the selected articles were reviewed by a third nutritionist. Articles that did not adequately meet inclusion criteria were excluded.

Where sufficient information was provided, original research was located using PubMed and other online databases. Articles with insufficient information to locate original research or not based on published research were not excluded. Each article was coded with a unique ID number. Descriptive data such as, the newspaper title, article size, date and day of publication and journalist's name, were extracted for each article. Articles were categorised into aspect of diet and health outcome covered in the publication. Dietary components were broadly categorised according to *The Eatwell guide*[20] but with high fat and high sugar foods separated into different food categories as these are usually covered separately in the media.

The size of the article in column inches was measured using a standard method (column inches high x number of columns). Articles were then categorised into either small (≤ 19.9 inches), medium (20 – 34 inches) or large (≥ 35 inches) based on space allocated to articles. The cut-off points for these categories were based on the average column inches for less than half page, half a page and more than half a page. Articles were categorised as being anonymous with no journalist name provided or as named if the author of the article was provided (known as a by-line).

Quality Assessment Measure

Each article was reviewed and graded using a validated Quality Assessment Tool[18]. The tool assessed different aspects of reporting quality such as generalisability and significance of findings, editorial

content, credibility of source, and representativeness of research used. The tool consists of 21 items, and points were awarded or deducted based on whether the article met the criteria. Items 1-8 and 18-21 were considered essential criteria, for these questions, points were deducted if the criteria were not met. Items 9-17 were considered desirable and points were awarded if the criteria were met and zero if the criteria was not met (see the complete list of questions published by Robinson et al[18]). Articles could receive a maximum of 17 points or minimum of -12. Following grading, articles were categorised based on the quality of reporting with poor quality (scoring < 0), satisfactory (0 – 10), or high quality (> 10) recommended by Robinson et al[18].

Statistical analysis

Descriptive statistics were conducted by newspaper type to obtain frequencies, mean values and to determine the spread of data for quality score, size of article and whether anonymously written. Regression models were generated with article quality score as the outcome variable and each of the following predictor variables modelled in turn; newspaper name, day and week of publication, article size, whether there was a named author (by-line), health-outcome reported and food type reported. A test of the overall model for each predictor was reported together with percentage variation in quality score attributable to each of the individual predictor variables. The reference category in each model was the category with the lowest quality score and each category was compared with the reference. In order to account for any correlations between the predictor variables such as articles on obesity being more likely to be published on particular days of the week, a full regression model was used with article quality score as the outcome variable and with all predictors in the model. Due to the number of weeks sampled being a smaller subset of weeks over the year a sandwich estimator was used to take account of the articles being clustered within weeks. The percentage variation in quality score explained by all predictor variables was reported and compared with previous results. To determine whether newspaper type was a significant predictor of quality score in the full model a likelihood ratio test was used to compare the model without including paper type with the model including paper type. Key aspects of the articles included in the quality assessment tool that were particularly unlikely to be

met were discussed as well as any substantial differences between newspapers. Residuals of the models were checked for approximate normality. Analysis was conducted using StataIC 14 with level of significance set at P-value of <0.05.

RESULTS

Descriptive Analysis

In total, 141 different articles were published over the 6 week period (see **Error! Reference source not found.**) in the five newspapers. Five articles on heart disease were excluded, which were initially included, as they focussed on statins rather than dietary intake. A mean of 24 articles were published each week and a mean of four articles were published each day. *The Daily Mail* had the most publications relating to nutrition and health over the period studied (n = 40). Their articles accounted for 28.4% of the total publications. In contrast, *the Sun* published the fewest articles (n = 20), accounting for 14.2% of the total publications. Papers varied in the proportion of small articles and anonymous articles and none of the papers published high quality articles as defined by the quality assessment tool (see table 1).

Table 1: Descriptive information on quality scores, article size and whether named journalist listed by newspaper name

Newspaper	N (%)	Quality score		Quality category (%)		Article size N (%)			
		Mean	**(95% CI)**	**Poor**	**Satisfactory**	**Small**	**Medium**	**Large**	**Journalist(%)**
The Sun	20 (14)	-0.6	-3.0 – 1.9	9(45)	11(55)	14(70)	0 (0)	6 (30)	12 (60)
The Daily Mirror	23 (16)	2.2	0.3 – 4.2	7(30)	16(70)	15 (65)	2 (9)	6 (26)	17 (74)
The Daily Mail	40 (28)	1.5	-0.2 – 3.1	13(33)	27(67)	21 (53)	11 (28)	8 (20)	25 (63)
The Daily Express	30 (21)	2.6	0.9 – 4.4	8(27)	22(73)	14 (47)	6 (20)	10 (33)	24 (80)
The Daily Telegraph	28 (20)	2.5	0.6 – 4.5	7(25)	21(75)	23 (82)	5 (18)	0 (0)	20 (71)
Total	**141 (100%)**	**1.8**	**0.9 – 2.6**	**44(31)**	**97(69)**	**87 (62%)**	**24 (17%)**	**30 (21%)**	**98 (70%)**

Quality assessment

The quality scores across the newspapers ranged from -9 to 10, with an overall mean (SD) score of 1.76 (5.03). The distribution of scores was broadly symmetrical. On average, the newspaper publishing the highest quality articles was *The Daily Express* with a mean score of 2.6. *The Sun* had the lowest quality of reporting at -0.55, with 45% of articles rated poor quality *(*see table 1*)*. In total, 44 (31.2%) articles were rated poor quality (score < 0) and 97 (68.8%) were rated satisfactory quality (0-10). There were no high quality articles (score > 10). There was no overall significant effect of newspaper type on quality score (p=0.19) and newspaper type contributed 2% to difference in variation in quality score. However, there were differences between the quality of articles observed between some of the individual newspapers. Comparisons with articles from the Sun (the newspaper with the lowest quality score), indicated that Daily Mail articles had an average quality score 2.0 points higher (95% CI -0.7 to 4.7, p=0.15) and Daily Mirror articles had a mean quality score 2.8 points higher (96% CI -0.2 to 5.8, p=0.07). Two newspapers had quality scores significantly higher than the Sun and these were Daily Telegraph articles with a mean quality score 3.1 points higher (95% CI 0.2 to 6.0, p=0.04) and Daily Express articles with a mean quality score 3.2 points higher (95% CI 0.3 to 6.0, p=0.03).

There was a significant difference in the quality of reporting between weeks and between days of the week. Mean scores for week 1 to 6 varied and were -3.4, 3.0, 3.0, 0.7, 2.5 and 3.4 consecutively. A test of the overall model indicated a significant difference between weeks (p<0.01) and percent variation in quality score explained by week of publication was 16%. Comparisons with week 1 (the week with articles of the lowest quality score) indicated that week 2 and 3 articles had quality scores 6.4 points higher (95% CI 3.7 to 9.1 and 3.6 to 9.1 respectively, p < 0.01 for both), week 4 articles had quality scores 4.1 points

higher (95% CI 1.2 to 6.9, p<0.01), week 5 articles had quality scores 5.9 points higher (95% CI 3.0 to 8.7, p<0.01) and week 6 articles had quality scores 6.7 points higher (95% 4.0 to 9.5, p<0.01). Day of publication also appeared to be important. Mean scores for Monday to Saturday were 1.2, -0.1, 1.6, 4.4, 3.4 and 1.1 respectively. A test of the overall model indicated that day was a significant factor for quality score (p=0.02) and contributed 6% of the variation in quality score. Comparisons with Tuesday, the day with the lowest quality score, indicated that articles published on Monday had mean quality scores 1.3 points higher (95% CI -1.2 to 3.7, p=0.31), Wednesday articles had mean quality scores 1.7 units higher (95% CI -0.8 to 4.2, p=0.19), Thursday articles had mean scores 4.4 units higher (95% CI 1.9 to 6.9, p<0.01), Friday articles had mean scores 3.5 units higher (95% CI 0.5 to 6.4, p=0.02) and Saturday articles had mean scores 1.2 units higher (95% CI -1.7 to 1.6, p=0.44).

There were 48 named journalists across the 141 articles. These journalists were responsible for publishing 98 (69.5%) of the articles reviewed. The remaining 43 (30.5%) articles were published anonymously (table 1). The Sun had the highest number of anonymous publications (n = 8, 40.0%), followed by The Daily Mail (n = 15, 37.5%). A test of the effect of Journalist on quality score indicated a significant effect (p<0.01) and whether a journalist was named or not contributed 19% to the variation in quality score. Articles with a named journalist had a quality score 4.8 points higher than those without a named journalist (95% CI 3.2 to 6.4, p<0.01) with a mean score of 3.2 compared to -1.6.

The majority of articles were categorised as small (n=87, 61.7%), (table 1). *The Daily Express,* had the greatest number of large sized articles (n = 10, 33.3%) while the broadsheet, *The Daily Telegraph,* had no large sized articles for nutrition. Small, medium

and large articles had mean quality scores of 1.0, 4 and 2.1 respectively and a test of the overall effect of article size on quality score was significant ($p<0.01$) with 6% of the variation in quality score explained. As there was no consistent trend by size and medium and large articles were similar these two categories were combined to give 2 categories small and larger.

The majority of articles discussed diet and nutrition in relation to their effect on health and wellbeing. Conditions covered most often were obesity (n = 35, 24.8%), CVD (n = 34, 24.1%) and neurological disorders (n = 22, 15.6%). The main dietary components covered were food and drinks high in fat, salt and/or sugar (n = 30, 21.3%), energy (n = 27, 19.1%) and fruits and vegetables (n= 25, 17.7%). There was a significant difference in the quality of reporting observed across different health categories ($p < 0.01$) with health category contributing 9% of the variation in quality score. Articles focussing on obesity were of the lowest quality compared with all other health categories (table 2) with a mean quality score of -0.9. Comparisons with obesity articles showed that articles on cancers had a mean quality score 3.5 units higher (95% CI -0.2 to 7.3, p=0.06), articles on CVD had a mean quality score 4.4 units higher (95% CI 2.1 to 6.7, p<0.01), articles on neurological disorders had a mean quality score 3.1 units higher (95% CI 0.5 to 5.6, p=0.02) and articles on life expectancy had a mean quality score 3.0 units higher (95% CI -0.4 to 6.4, p=0.08). There was no substantial difference between the quality of reporting for different food topics (p = 0.73) with 0% of variation in quality score explained by food category.

Table 2. *Number, percent, mean scores of article quality and 95% confidence interval (95% CI) for each of the eight different categories of food type and 8 different categories of health outcome. A higher score indicates a higher quality newspaper article*

Category	N	%	Mean score	95% CI
Food Categories				
Energy (Kcals)	27	19	1.0	-0.7 to 2.7
Alcohol	18	13	2.7	0.6 to 4.8
Fruit and vegetables	25	18	1.8	-.8 to 4.3
High fat & processed foods	21	15	0.6	-1.7 to 2.8
Protein rich foods	8	6	4.0	1.3 to 6.7
Dairy foods	13	9	1.5	-1.7 to 4.6
Sugary drinks & confectionery	9	6	1.8	-2.5 to 6.1
Other (vitamins & ingredients)	20	14	2.5	-.2 to 5.1
Health Categories				
Cancers	8	6	2.6	-1.2 to 6.4
Cardiovascular health	34	24	3.5	1.6 to 5.4
Diabetes	17	12	3.5	1.2 to 5.8
Obesity	35	25	-0.9	-2.2 to 0.4
Neurological disorders	22	16	2.1	0.2 to 4.0
Life expectancy	10	7	2.1	-0.9 to 5.1
Respiratory, endocrine or reproductive	12	9	0	-3.1 to 3.1
Muscular Skeletal	3	2	4.7	2.3 to 7.0
Overall	**141**	**100%**	**1.8**	**0.9 to 2.6**

We investigated whether the results of the predictors of article quality were attenuated in a multiple regression model where each predictor was adjusted for the remaining predictors. The articles were nested within weeks using a sandwich estimator. The majority of the previously identified significant predictor variables remained significant when adjusted for other variables (see table 3). The full model explained 43% of the variation in article quality scores. A test to determine whether the model including paper type explained significantly more of the variation in score compared with the model without paper type

was not significant (p=0.85) indicating that the type of newspaper was not important in terms of article quality when other factors were taken into account. The food type was also not an important predictor. Articles published on Monday and Thursday had particularly high scores as did articles on CVD. Having a named journalist and longer article length also remained important predictors of article quality.

Table 3: Predictors of quality score for different factors including paper type, week, day, food category, health category, named journalist and article size.

Factors predicting article quality score	n	Coefficient	95% CI co-efficient	P value
Paper title: Reference category is The Sun	**20**			
The Daily Mirror	23	0.7	-5.9 to 7.3	0.80
The Daily Mail	40	0.4	-2.9 to 3.7	0.77
The Daily Express	30	0.8	-2.0 to 3.6	0.50
The Daily Telegraph	28	0.4	-1.9 to 2.7	0.67
Day: reference category is Tuesday	**35**			
Monday	27	2.5	0.5 to 4.5	0.02
Wednesday	25	3.1	-0.7 to 6.9	0.09
Thursday	25	3.9	2.1 to 7.0	0.01
Friday	15	3.7	-0.7 to 8.1	0.08
Saturday	14	-0.7	-5.2 to 3.8	0.70
Food: reference category is High fat foods	**21**			
Energy (KCals)	27	1.2	-3.8 to 6.2	0.56
Alcohol	18	2.9	-2.0 to 7.7	0.19
Fruit and vegetables	25	0.6	-6.3 to 7.6	0.83
Protein foods	8	1.8	-5.3 to 8.8	0.64
Dairy foods	13	2.8	-1.8 to 7.4	0.17
Sugary drinks and confectionery	9	2.6	-1.1 to 6.3	0.13

Other (vitamins, ingredients)	20	1.3	-4.9 to 7.5	0.62
Health: reference category is obesity	**35**			
Cancer	8	5.3	-1.1 to 11.7	0.09
CVD	34	3.7	1.4 to 6.0	<0.01
Type 2 Diabetes	17	3.5	-0.6 to 7.5	0.08
Neurological disorders	22	3.2	-0.7 to 7.2	0.09
Life Expectancy	10	2.4	-3.0 to 7.7	0.31
Other (respiratory, reproductive)	12	2.0	-1.0 to 5.0	0.14
Named journalist: reference category is No	**43**			
Yes, named journalist	98	3.8	0.3 to 7.2	0.04
Article Size: reference category is small	**82**			
Larger articles	59	2.2	1.4 to 3.0	<0.01

We investigated which of the 21 questions making up the quality score for each newspaper faired particularly badly. Table 4 provides a breakdown of the scores for each of the 21 items for individual newspapers. The analysis revealed that 54% of articles ranked negatively for Q1 and 40% ranked negatively for Q2, which meant that more than half the articles were not based on published research or did not cite the journal of publication and nearly half did not provide an author name. It would be particularly difficult to locate and read the original research article without this information. The newspapers differed significantly in what proportion of their articles met these two criteria. The majority of articles omitted essential information such as number of participants (Q4), and whether the findings differed from previous research (Q5) [61% and 73% retrospectively] but these results did not vary substantially by newspaper. Furthermore, the majority (90%) of articles did not state whether the results of research were statistically significant (Q11). *The Daily Express* had the most negatively scored articles for Q19, meaning the article had the

Question	The Sun (n = 20)	Daily Mirror (n = 23)	Daily Mail (n=40)	Daily Express (n=30)	Daily Telegraph (n = 28)	All papers (n = 141)

"potential to cause undue harm or optimism". *The Sun* and *The Daily Express* were most likely to score negatively for Q21, stating a "breakthrough" or "cure" in articles. The majority of articles (70%) quoted a second opinion from a specialist (e.g. health professional, nutritionist, or academic).

Table 4. Percentage of articles meeting and not meeting the criteria for each of the 21 items in the validated quality assessment tool. Results presented for individual papers and for all papers combined. For each item met, a value of +1 (criteria 1 and 2) or zero (criteria 3) is achieved and for each item not met, either a zero (criteria 2) or -1 (criteria 1 and 3) is achieved.

Criteria 1	+1	-1	+1	-1	+1	-1	+1	-1	+1	-1	+1	-1
Q1	20	80	61	39	37	63	57	43	54	46	46	54
Q2	35	65	52	48	55	45	80	20	71	29	60	40
Q3	70	30	78	22	80	20	90	10	82	18	81	19
Q4	25	75	26	74	43	57	40	60	54	46	39	61
Q5	15	85	26	74	27	73	33	67	29	71	27	73
Q6	35	65	43	57	30	70	33	67	36	64	37	63
Q7	45	55	70	30	77	23	70	30	79	21	70	30
Q8	75	25	78	22	70	30	70	30	71	29	72	28
Criteria 2	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**
Q9	10	90	17	83	25	75	40	60	21	79	24	76
Q10	20	80	17	83	20	80	17	83	18	82	18	82
Q11	15	85	9	91	5	95	10	90	14	86	10	90
Q12	0	100	0	100	5	95	13	87	4	96	5	95
Q13	0	100	0	100	0	100	3	97	4	96	1	99
Q14	0	100	4	96	5	95	0	100	0	100	2	98
Q15	15	85	35	65	15	85	10	90	25	75	19	81
Q16	70	30	78	22	70	30	80	20	50	50	69	31
Q17	25	75	26	74	15	85	17	83	14	86	18	82
Criteria 3	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**
Q18	5	95	9	91	3	97	0	100	0	100	3	97
Q19	20	80	22	78	28	72	37	63	29	71	28	72
Q20	10	90	13	87	15	85	17	83	11	89	13	87
Q21	20	80	17	83	10	90	23	77	7	93	15	85

294

DISCUSSION

This is the first study that explores in detail a range of predictors of quality of nutrition related articles. We found that there was little variation between different newspapers and the main differences in article quality were explained by the article content, the length of the article and whether there was a named journalist. Quality of articles also varied by day and by week. These differences in article quality could possibly be related to editorial policy and other factors that were not considered here however these factors explained nearly half of the variation in quality score. Articles with the lowest quality scores were; those covering obesity, small in size, written anonymously and published on Tuesdays. The poor quality of articles on obesity was particularly worrying. Poor quality reporting can lead to readers being confused or uninterested in the poor information provided[21]; a serious concern given that obesity affects a quarter of the UK adult population[22] and many readers may rely on information from newspapers about how to lose weight[23]. There are high levels of stigma around the subject of obesity and its possible causes and solutions which may lead to journalists including information in their articles that is based on their belief system as well as the scientific evidence.

Journalists have the complex role of translating scientific information to the lay public and it is important that the authors have sufficient understanding to ensure the correct balance between portraying scientific information accurately and making the information clear and readable. On the other hand, journalists must make the story "eye-catching" and "appealing" for the public, which can lead to nutrition articles containing sensationalist reporting, alarmist headlines or contradictory information, resulting in confusion or distrust of dietary recommendations[14 24]. Journalists are in a position to shape social norms and attitudes through their choice of topics to publish and therefore may influence

understanding of, and appetite, for particular stories but ultimately the role of journalists is to provide news that is interesting and sells newspapers and not to act as a public health service to the masses. Of the five newspapers reviewed, *s*ome papers published more nutrition articles than others a finding which is consistent with previous research[18]. However, it may be more beneficial to the public to have fewer higher quality articles rather than many articles of low quality. Articles may be published in newspapers if the editors believe it will be of interest to readers and therefore a large number of articles can be seen as a positive sign that readers (the public) are interested in nutrition and health. On the other hand, the public do not want poor quality reporting. One study reported that more than three quarters (81%) of those surveyed said they only wanted to hear about findings once "there is acceptance among nutrition and health professionals"[25]. The current situation needs to take these views into account. We did not collect relevant information to determine why quality of articles varied by day and the reasons for this need to be explored further.

University press officers, researchers and scientific journals also have a key part to play in improving the quality of research reported in the media. A content analysis[26] revealed that academic press releases play an influential role in the quality of news articles but highlighted that many of the exaggerations of media articles stemmed from exaggerations in academic press releases. Nevertheless, the best quality newspaper articles are based on scientific research (usually based in a university) that is published in a scientific journal rather than unpublished research promoted by PR agencies. Improving the quality of reporting in the news perhaps lies firstly with universities and scientific journals providing easier to understand information that can be understood by a non-specialist audience. Scientific journals may prefer to disseminate press releases on some days more often than

others which could contribute to the differences by day of the week. Some newspapers were more likely to report on studies that were not from scientific journals, and therefore one recommendation is to encourage all newspapers to increase the proportion of articles based on published studies and to cite the study in the newspaper article.

Previous research has highlighted that the mass media can be an effective tool health professionals can utilise as a way to increase public knowledge of aspects of public health such as physical activity[6 7] or drink-driving[27] and therefore it is beneficial for scientists to work with the media more closely to increase the proportion of high quality articles. The best quality articles are more likely to have certain attributes. They need to be large enough to cover many of the main points, a similar finding to previous research[10 18]. We would suggest that medium sized articles of length 20 to 34 column inches are needed to successfully provide sufficient context for readers to understand the main points of the research, the conditions attached to the research and the quality of the study design. Higher quality articles are also more likely to be written by a named journalist (with a by-line), often with a declared interest in health however, a third had no name provided. It has previously been suggested that the un-named author may know less about health issues and have had little training in this area[28] however, this is not necessarily true. Health journalists could be more likely to publish articles without a by-line due to differences in editorial policy between newspapers. Articles that have come from press releases may be more likely not to have a by-line and therefore we support more transparency on the source of the information and recommend that more nutrition articles are published by a trained health journalist. Training for journalists is available in the UK such as that provided at the Science Media Centre in London; although little is offered on nutrition and the Centre receives corporate funding which may mean it is not neutral. We recommend more

rigorous training of journalists in scientific study design and more dialogue between journalists and scientists to improve the choice of studies covered in the news. A recent review of media quality in Australia concluded that although quality of news media was low, it had recently improved with benefits and harms more accurately provided. This was mainly limited to online news articles[29] but indicates that progress can be made. This will only be achieved if journalists, scientists and academic press offices work together as has previously been highlighted[30].

There are a number of notable limitations to this research. Data was only collected for a limited period from a limited number of papers. It is likely that there are differences between newspapers although we saw little difference between newspapers here. It is likely that some newspapers that we have not included are different in format and editorial policy and vary in the quality of their nutrition related articles. Therefore, it is possible that we have not captured a true picture of the quality of nutrition articles in all newspapers. It is also likely that fluctuations may occur when a nutrition topic of particular interest is covered in the news which may increase the proportion of larger articles written or the number of articles categorised under a particular health outcome. Importantly, most newspapers have reported declines in circulation figures as more people are turning to alternative sources e.g. online news websites and blogs[31], although the newspapers that we included in our survey (mostly tabloids) did also have an online presence. Many additional articles will have been published on the online version but we did not explore this. More research is required to assess online sources of news in order to capture a true picture of the quality of nutrition related articles. A validated tool to assess quality from online news sources is urgently needed in order to achieve this. Some of the methods used to measure article attributes do not have universally agreed standards, for example methods for

measuring article size. These methods are prone to measurement error and could be improved in future.

It was highlighted in the 1990s[32] that health research was often misrepresented and preliminary research reported as a breakthrough. These findings are mirrored in our study, indicating that despite steps being taken to improve the situation many of these issues still persist. It is therefore essential that further measures are made to improve the quality of nutrition coverage and minimise the damage to public health[33 34 35]. Firstly, we propose that journalists have adequate training in issues related to scientific methods and health. Secondly, newspaper editors should consider publishing a smaller number of higher quality articles based on studies published in scientific journals. Thirdly, researchers, health professionals, university and journal press officers are key and could assist in providing clear information which follows a standard format to media sources as well as support with training. Finally, all parties need to work together to ensure that nutrition coverage and health messages published for the public are both clear and informative as well as interesting and exciting. Establishing common ground between stake-holders is central to improvement.

Contributors

CE provided the original research idea, supervised the research, wrote the first draft of the discussion and critically reviewed the first and subsequent drafts of the manuscript. AK checked and analysed the data, wrote the first draft of the manuscript and contributed to all subsequent drafts. NA and NJ contributed to the design of the survey, collected the data, contributed to the analysis of the data and reviewed the final draft of the manuscript.

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We have no competing interests.

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No additional data are available for analysis.

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Quality assessment of nutrition coverage in the media: A 6 week survey of five popular UK newspapers

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ABSTRACT

Objectives: This study aims to investigate the quality of nutrition articles in the top five national daily newspapers in the UK and to identify important predictors of quality both between and within newspaper title.

Setting: Newspapers are a primary source of nutrition information for the public.

Design: Newspaper articles were collected on 6 days of the week (excluding Sunday) for 6 weeks in summer 2014. Predictors included food type and health outcome, size of article, whether or not the journalist was named and day of the week.

Outcome measures: A validated Quality Assessment Tool was used to assess each article, with a minimum possible score of -12 and a maximum score of 17. Newspapers were independently checked in duplicate for relevant articles. The association of predictors on quality scores were analysed individually and then combined using regression models with quality score as the outcome measure.

Results: A total of 141 nutrition articles were included across the 5 newspapers over 6 weeks. The median quality score was 2 (interquartile range -2 to 6) and 31% of articles were of poor quality (score less than zero). There was no substantial variation in quality of reporting between newspapers once other factors such as anonymous publishing, health outcome, aspect of diet covered and day of the week were taken into account. Particularly low quality scores were obtained for anonymously published articles with no named journalist, articles that focussed on obesity and articles that covered high fat and processed foods.

Conclusions: The general public are regularly exposed to poor quality information in newspapers about what to eat to promote health, particularly articles reporting on obesity. Journalists, researchers, university press officers and scientific journals need to work together more closely to ensure clear, consistent nutrition messages are communicated to the public in an engaging way.

ARTICLE SUMMARY

- A large number of nutrition articles from newspapers were analysed for article quality using a validated Quality Assessment Tool
- Key factors were tested for prediction of article quality adjusting for other factors
- Additional sources of media such as online and social media were not included in the analysis
- Newspaper articles were collected over 6 weeks but longer time periods may be needed to explain some of the differences in article quality due to variation in quality each week

INTRODUCTION

Chronic conditions such as obesity, cardiovascular disease (CVD), type II diabetes and stroke are leading causes of death, accounting for 86% of total deaths in the UK[1]. As a result of lifestyle factors such as poor diet, physical inactivity, and excess weight playing key roles in the development of these chronic conditions[2 3], 33,000 deaths each year could be avoided if the UK dietary recommendations were met[4]. Therefore, raising knowledge and awareness of dietary guidelines in an effort to educate and encourage the public to make a conscious decision about their dietary intake could help to significantly improve the health of the population and reduce the incidence of these conditions[5].

The media is comprised of the internet, radio, television, smartphones, and printed newspapers and media communications, many of which have been shown to have an influential effect on the public's knowledge and awareness of health issues, which has the potential to promote positive behaviour change[6 7]. Only a decade ago, tabloid and broadsheet newspapers were the primary source of health based information[8], however news from social media sources such as Facebook and Twitter are now popular. Nevertheless, despite a dramatic increase in the use of online media[9], printed newspapers remain an efficient way of providing the public with essential information[10 11]. Therefore, it is likely that good quality reporting by health correspondents in printed newspapers has the potential to be more successful in raising awareness of health related issues that would then allow the public to make informed decisions[11].

Previous research has shown that nutrition coverage has often been sensationalist, with the headlines not accurately reflecting the scientific research[12] and based on reporting preliminary research as a "breakthrough"[13]. The media have been criticised for their classification of "newsworthy" stories[13] and one study reported that 72% of articles were based on low quality scientific evidence[10]. It is common to present contradictory messages or an unbalanced view about health and nutrition in many media articles[14-16]. On the other hand, newspapers do not exist to provide a free public health service to the public but to provide newsworthy articles[17].

A review of the quality of 160 health based articles (although not necessarily nutrition related articles) in eight UK newspapers over 4 weeks revealed significant differences in the quality of reporting between newspapers[18] with *The Times* publishing the highest quality articles and *The Sun* the lowest. Their findings highlighted aspects of an article related to editorial policy that affected the quality of reporting such as article length, journalist, and credibility of source; however they did not explore how these predictors of quality explained variation in quality by paper type or whether they interacted with each other. Therefore, the main aims of this study were to use the existing validated quality assessment tool by Robinson et al[18] to assess the quality of nutrition coverage in particular in five of the highest circulating printed newspapers and to determine the most important predictors of article quality to explain any differences in article quality between papers. We also made recommendations to improve the quality of future nutrition and health reporting in the media.

METHODS

Data collection

Five of the highest six circulating tabloid and broadsheet national newspapers in the UK were examined in the summer of 2014. Four tabloid newspapers (*The Sun*, *The Daily Mirror*, *The Daily Mail* and *The Daily Express*) and one broadsheet, (*The Daily Telegraph*) were included in this study. We omitted the Daily Standard from the included list, as it is not available outside London. Both tabloid and broadsheet newspapers were included to understand whether there were any differences in predictors of quality of the nutrition coverage in these forms of media. Audiences vary between the two types of newspaper with tabloids generally targeting audience with a lower socio-economic background[19].

Printed editions of the five newspapers were collected on 6 days of the week (Monday to Saturday) for 6 weeks from 30 June 2014 to 9 August 2014. Sunday was excluded from the data collection as a pilot study revealed repetition of nutrition/health articles from previous days. Each printed newspaper was

scanned by a researcher in its entirety. Articles covering an aspect of nutrition (as an exposure) and an aspect of human health (as a health outcome) were identified and extracted for inclusion in this study. Articles were excluded if a) they covered nutrition but without a related health outcome (for example the use of cucumber as a beauty therapy); or b) they covered a health outcome such as heart disease without discussing diet. Articles from opinion columns were also excluded. This process was carried out in duplicate and independently by a second researcher and the selected articles were reviewed by a third nutritionist. Articles that did not adequately meet inclusion criteria were excluded.

Where sufficient information was provided, original research was located using PubMed and other online databases. Articles with insufficient information to locate original research or not based on published research were not excluded. Each article was coded with a unique ID number. Descriptive data such as, the newspaper title, article size, date and day of publication and journalist's name, were extracted for each article. Articles were categorised into aspect of diet and health outcome covered in the publication. Dietary components were broadly categorised according to *The Eatwell guide*[20] but with high fat and high sugar foods separated into different food categories as these are usually covered separately in the media.

The size of the article in column inches was measured using a standard method (column inches high x number of columns). Articles were then categorised into either small (≤ 19.9 inches), medium (20 – 34 inches) or large (≥ 35 inches) based on space allocated to articles. The cut-off points for these categories were based on the average column inches for less than half page, half a page and more than half a page. Articles were categorised as being anonymous with no journalist name provided or as named if the author of the article was provided (known as a by-line).

Quality Assessment Measure

Each article was reviewed and graded using a validated Quality Assessment Tool[18]. The tool assessed different aspects of reporting quality such as generalisability and significance of findings, editorial

content, credibility of source, and representativeness of research used. The tool consists of 21 items, and points were awarded or deducted based on whether the article met the criteria. Items 1-8 and 18-21 were considered essential criteria, for these questions, points were deducted if the criteria were not met. Items 9-17 were considered desirable and points were awarded if the criteria were met and zero if the criteria was not met (see the complete list of questions published by Robinson et al[18]). Articles could receive a maximum of 17 points or minimum of -12. Following grading, articles were categorised based on the quality of reporting with poor quality (scoring < 0), satisfactory (0 – 10), or high quality (> 10) recommended by Robinson et al[18].

Statistical analysis

Descriptive statistics were conducted to obtain frequencies, median values and interquartile range for quality score. In all the models, due to the lack of normality in the distribution of the quality scores, the scores were categorised into two groups; poor (quality score of less than zero) or acceptable (quality score of zero or above) based on the work by Robinson[18]. Descriptive data were provided for the different categories of food and health covered by the articles, anonymous reporting, article size and days of the week including median and interquartile range of quality score for each category. Logistic regression models were generated with article quality score as poor or acceptable as the binary outcome variable. In the first model differences in quality score by newspaper type were tested without adjusting for any predictor variables. Differences between all pairs of paper type were not tested due to issues with multiple testing. In the second model, predictors were included in the model namely; day of publication, article size, whether there was a named author (by-line), the health-outcome covered and food type covered in the article. In both models, due to the number of weeks sampled being a smaller subset of weeks over the year the results were clustered within weeks using a sandwich estimator[21]. To determine whether newspaper type and each predictor were explaining significant amounts of variation in quality score we took a nested model approach. A likelihood ratio test was used with each factor in turn, comparing the model without and with each factor and P values of each test were reported. The reference category for each variable was the most common category which had the largest number of

articles and each of the remaining categories were compared with the reference. Residuals of the models were checked for approximate normality. Analysis was conducted using StataIC 14 with level of significance set at P-value of <0.05. Key aspects of the articles included in the quality assessment tool that were particularly unlikely to be met were discussed as well as any substantial differences between newspapers.

RESULTS

Descriptive Analysis

In total, 141 different articles were published over the 6 week period (see **Error! Reference source not found.**) in the five newspapers. Five articles on heart disease were excluded, which were initially included, as they focussed on statins rather than dietary intake. A mean of 24 articles were published each week and a mean of four articles were published each day. *The Daily Mail* had the most publications relating to nutrition and health over the period studied (n = 40). Their articles accounted for 28.4% of the total publications and therefore was used as the reference category in subsequent analysis. In contrast, *the Sun* published the fewest articles (n = 20), accounting for 14.2% of the total publications. Papers varied in the proportion of small articles and anonymous articles and none of the papers published high quality articles as defined by the quality assessment tool (see table 1).

Table 1: Descriptive information on quality scores, article size and whether named journalist listed by newspaper name (*IQR=Interquartile range)

Newspaper	N (%)	Quality score		Quality category (%)		Article size N (%)			
		Median	**IQR***	**Poor**	**Satisfactory**	**Small**	**Medium**	**Large**	**Journalist(%)**
The Sun	20 (14)	0.5	-5.5 to 4	9(45)	11(55)	14(70)	0 (0)	6 (30)	12 (60)
The Daily Mirror	23 (16)	1	-2 to 7	7(30)	16(70)	15 (65)	2 (9)	6 (26)	17 (74)
The Daily Mail	40 (28)	2	-1.5 to 4.5	13(33)	27(67)	21 (53)	11 (28)	8 (20)	25 (63)
The Daily Express	30 (21)	2.5	-1 to 6	8(27)	22(73)	14 (47)	6 (20)	10 (33)	24 (80)
The Daily Telegraph	28 (20)	3	-1.5 to 7.5	7(25)	21(75)	23 (82)	5 (18)	0 (0)	20 (71)
Total	**141 (100%)**	2	-2 to 6	**44(31)**	**97(69)**	**87 (62%)**	**24 (17%)**	**30 (21%)**	**98 (70%)**

Quality assessment

The quality scores across the newspapers ranged from -9 to 10, with an overall median score of 2. In total, 44 (31.2%) articles were rated poor quality (score of less than zero) and 97 (68.8%) were rated satisfactory quality (score of 0-10). There were no high quality articles (score of more than 10). The median quality scores varied between paper type; the lowest being 0.5 for The Sun and the highest being 3 for the Daily Telegraph. The percentage of articles that achieved a score of zero or above (and therefore defined as satisfactory quality) varied between papers and was lowest for the Sun at 55% and highest for the Daily Telegraph at 75% (see table 1). Median scores for week 1 to 6 varied and were -4, 3, 3, 0, 3.5 and 5 consecutively. Weeks were adjusted for in the analysis. Logistic regression results using The Daily Mail as the reference category indicated there was an overall significant effect of newspaper type on percent of articles of satisfactory quality ($p=<0.01$) but none of the individual papers had a significantly different percent of satisfactory articles compared with the Daily Mail.

We investigated the importance of five different predictor variables. Quality scores varied by day of the week. Median scores for Monday to Saturday were 1, 0, 0, 4, 4 and 2 respectively with higher scores on Thursday and Friday and lower scores on Tuesday and Wednesday. More articles were published on Tuesday than any other day and therefore this was used as the reference category in subsequent analysis.

There were 48 named journalists across the 141 articles. These journalists were responsible for publishing 98 (69.5%) of the articles reviewed. The remaining 43 (30.5%) articles were published anonymously (table 1). The Sun had the highest number of anonymous publications (n = 8, 40.0%) and The Daily Express had the least (n= 6, 20%). Articles with

a named journalist had a median quality score of 3 compared with a median score of -2 for articles that were anonymous.

The majority of articles were categorised as small (n=87, 61.7%), (table 1). Small, medium and large articles had median quality scores of 1, 3.5 and 5 respectively. *The Daily Express,* had the greatest number of large sized articles (n = 10, 33.3%) while the broadsheet, *The Daily Telegraph,* had the largest number of small articles (n=23, 82%) (see table 1).

The majority of articles discussed diet and nutrition in relation to their effect on health and wellbeing. Conditions covered most often were obesity (n = 35, 24.8%), CVD (n = 34, 24.1%) and neurological disorders (n = 22, 15.6%). The main dietary components covered energy (n = 27, 19.1%) and fruits and vegetables (n= 25, 17.7%). Quality scores varied across different health outcomes and different food topics (see table 2). Articles focussing on obesity were of the lowest quality compared with all other health categories (table 2) with a median quality score of -1. Out of the different food topics covered, high fat and processed foods had the lowest quality score with a median of zero.

Table 2. *Number, percent, median scores of article quality and Interquartile Range (IQR) for each of the eight different categories of food type and 8 different categories of health outcome. A higher score indicates a higher quality newspaper article*

Category	N	%	Median score	IQR
Food Categories				
Energy (Kcals)	27	19	1	-3 to 4
Alcohol	18	13	3.5	0 to 5
Fruit and vegetables	25	18	3	-3 to 7
High fat & processed foods	21	15	0	-2 to 2
Protein and Dairy foods	21	15	3	0 to 6
Dairy foods	13	9	1	-1 to 6
Sugary drinks & confectionery	9	6	3	-4 to 7
Other (vitamins & ingredients)	20	14	3	-1.5 to 6.5
Health Categories				
Cancers	8	6	2.5	-0.5 to 7
Cardiovascular health	34	24	4	0 to 8
Diabetes	17	12	4	2 to 6
Obesity	35	25	-1	-4 to 2
Neurological disorders	22	16	2.5	0 to 5
Life expectancy	10	7	3.5	-3 to 5
Other (Respiratory, endocrine or reproductive, muscular skeletal)	15	11	3	-2 to 4
Overall	**141**	**100%**	**2**	**-2 to 6**

We investigated which of the different predictors were important at predicting article quality when all the predictors were included in a logistic regression model where each predictor was adjusted for the remaining predictors. The full model explained 34% of the variation in article quality score. The odds ratios (the odds of an article being defined as satisfactory for each category compared with the odds for the reference category) are displayed in table 3.

Likelihood ratio tests used to test the contribution of each variable to the model indicated that paper type was not a significant predictor of article quality once other factors were taken into account (see table 3). Article size was also not a significant predictor of article quality when other factors were taken into account. However day of the week, food category, health category and whether the journalist was named were all significant factors (see table 3).

For day of the week, compared with the reference category of Tuesday, Monday and Saturday articles had significantly different odds of having a satisfactory score. Articles published on Monday had nearly 4 times the odds of receiving a satisfactory score compared with Tuesday while articles published on Saturday had much lower odds of being defined as satisfactory compared with Tuesday. Compared with articles covering obesity, articles covering Cancer, CVD and Diabetes had more than 10 times the odds of receiving a satisfactory quality score. Articles with no by-line were far less likely to receive a satisfactory score.

Table 3: Predictors of quality score for different factors including paper type, week, day, food category, health category, named journalist and article size.

Factors predicting article quality score	n	Odds Ratio (OR)	95% CI OR	P value for comparison with ref	P value for likelihood ratio test
Paper title: Reference category is The Daily Mail	**40**				0.95
The Sun	20	0.80	0.03 to 25.21	0.90	
The Daily Mirror	23	0.60	0.07 to 4.84	0.63	
The Daily Express	30	0.78	0.10 to 5.83	0.81	
The Daily Telegraph	28	0.78	0.16 to 3.88	0.77	

Day: reference category is Tuesday	**35**				<0.01
Monday	27	3.90	1.09 to 13.92	0.04	
Wednesday	25	3.83	0.31 to 47.20	0.30	
Thursday	25	13.64	0.65 to 287.6	0.09	
Friday	15	6.94	1.02 to 47.19	0.05	
Saturday	14	0.21	0.09 to 0.53	<0.01	
Food: reference category is Energy	**27**				0.03
Alcohol	18	3.72	0.41 to 34.19	0.25	
Fruit and vegetables	25	0.66	0.04 to 11.81	0.78	
High fat and processed foods	21	0.39	0.02 to 8.49	0.55	
Protein and Dairy foods	21	4.66	0.36 to 60.27	0.24	
Sugary drinks and confectionery	9	1.56	0.25 to 9.67	0.63	
Other (vitamins, ingredients)	20	0.86	0.06 to 12.17	0.91	
Health: reference category is obesity	**35**				0.03
Cancer	8	24.30	3.17 to 186.2	<0.01	
CVD	34	11.73	2.69 to 51.24	<0.01	
Type 2 Diabetes	17	12.31	1.55 to 98.04	0.02	
Neurological disorders	22	7.18	0.85 to 60.84	0.07	
Life Expectancy	10	1.75	0.10 to 30.17	0.70	
Other (respiratory, reproductive)	12	3.61	1.04 to 12.61	0.04	
Named journalist: reference category is Yes	**98**				<0.01
No named journalist	43	0.10	0.01 to 0.84	0.03	
Article Size: reference category is small	**82**				0.52
Medium sized articles	36	0.92	0.66 to 2.78	0.88	
Large sized articles	23	2.79	0.66 to 11.75	0.16	

253

Question	The Sun (n = 20)	Daily Mirror (n = 23)	Daily Mail (n=40)	Daily Express (n=30)	Daily Telegraph (n = 28)	All papers (n = 141)

We investigated which of the 21 questions making up the quality score for each newspaper scored particularly badly. Table 4 provides a breakdown of the scores for each of the 21 items for individual newspapers. The analysis revealed that 54% of articles ranked negatively for Q1 and 40% ranked negatively for Q2, which meant that more than half the articles were not based on published research or did not cite the journal of publication and nearly half did not provide an author name. It would be particularly difficult to locate and read the original research article without this information. The newspapers differed significantly in what proportion of their articles met these two criteria. The majority of articles omitted essential information such as number of participants (Q4), and whether the findings differed from previous research (Q5) [61% and 73% retrospectively] but these results did not vary substantially by newspaper. Furthermore, the majority (90%) of articles did not state whether the results of research were statistically significant (Q11). *The Daily Express* had the most negatively scored articles for Q19, meaning the article had the "potential to cause undue harm or optimism". *The Sun* and *The Daily Express* were most likely to score negatively for Q21, stating a "breakthrough" or "cure" in articles. The majority of articles (70%) quoted a second opinion from a specialist (e.g. health professional, nutritionist, or academic). Different newspapers scored differently on different questions although no newspaper scored poorly on all questions.

Table 4. Percentage of articles meeting and not meeting the criteria for each of the 21 items in the validated quality assessment tool. Results presented for individual papers and for all papers combined. For each item met, a value of +1 (criteria 1 and 2) or zero (criteria 3) is achieved and for each item not met, either a zero (criteria 2) or -1 (criteria 1 and 3) is achieved.

Criteria 1	+1	-1	+1	-1	+1	-1	+1	-1	+1	-1	+1	-1
Q1	20	80	61	39	37	63	57	43	54	46	46	54
Q2	35	65	52	48	55	45	80	20	71	29	60	40
Q3	70	30	78	22	80	20	90	10	82	18	81	19
Q4	25	75	26	74	43	57	40	60	54	46	39	61
Q5	15	85	26	74	27	73	33	67	29	71	27	73
Q6	35	65	43	57	30	70	33	67	36	64	37	63
Q7	45	55	70	30	77	23	70	30	79	21	70	30
Q8	75	25	78	22	70	30	70	30	71	29	72	28
Criteria 2	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**
Q9	10	90	17	83	25	75	40	60	21	79	24	76
Q10	20	80	17	83	20	80	17	83	18	82	18	82
Q11	15	85	9	91	5	95	10	90	14	86	10	90
Q12	0	100	0	100	5	95	13	87	4	96	5	95
Q13	0	100	0	100	0	100	3	97	4	96	1	99
Q14	0	100	4	96	5	95	0	100	0	100	2	98
Q15	15	85	35	65	15	85	10	90	25	75	19	81
Q16	70	30	78	22	70	30	80	20	50	50	69	31
Q17	25	75	26	74	15	85	17	83	14	86	18	82
Criteria 3	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**
Q18	5	95	9	91	3	97	0	100	0	100	3	97
Q19	20	80	22	78	28	72	37	63	29	71	28	72
Q20	10	90	13	87	15	85	17	83	11	89	13	87
Q21	20	80	17	83	10	90	23	77	7	93	15	85

278

DISCUSSION

This is the first study that explores in detail a range of predictors of quality of nutrition related articles. We found that there were differences between papers in the percent of articles with an acceptable quality score when no predictor variables were included in the model. However when predictors such as food and health type reported in the article and whether there was a named journalist were taken into account there was little variation between different newspapers. Therefore the main differences in article quality were explained by the article content and author of the article. Quality of articles also varied by day of the week. These differences in article quality could possibly be related to editorial policy and other factors that were not considered here however these factors explained a third of the variation in percent of articles reaching an acceptable quality level. Articles with the lowest quality scores were those covering obesity and high fat and processed foods, written anonymously and published on Tuesdays. The poor quality of articles on obesity was particularly worrying. Poor quality reporting can lead to readers being confused or uninterested in the poor information provided[22]; a serious concern given that obesity affects a quarter of the UK adult population[23] and many readers may rely on information from newspapers about how to lose weight[24]. There are high levels of stigma around the subject of obesity and its possible causes and solutions which may lead to journalists including information in their articles that is based on their belief system as well as the scientific evidence.

Journalists have the complex role of translating scientific information to the lay public and it is important that the authors have sufficient understanding to ensure the correct balance between portraying scientific information accurately and making the information clear and readable. On the other hand, journalists must make the story “eye-catching” and

"appealing" for the public, which can lead to nutrition articles containing sensationalist reporting, alarmist headlines or contradictory information, resulting in confusion or distrust of dietary recommendations[14 25]. Journalists are in a position to shape social norms and attitudes through their choice of topics to publish and therefore may influence understanding of, and appetite for, particular stories but ultimately the role of journalists is to provide news that is interesting and sells newspapers and not to act as a public health service to the masses. Of the five newspapers reviewed, *s*ome papers published more nutrition articles than others, a finding which is consistent with previous research[18]. However, it may be more beneficial to the public to have fewer higher quality articles rather than many articles of low quality. Articles may be published in newspapers if the editors believe it will be of interest to readers and therefore a large number of articles can be seen as a positive sign that readers (the public) are interested in nutrition and health. On the other hand, the public do not want poor quality reporting. One study reported that more than three quarters (81%) of those surveyed said they only wanted to hear about findings once "there is acceptance among nutrition and health professionals"[26]. The current situation needs to take these views into account. We did not collect relevant information to determine why quality of articles varied by day and the reasons for this need to be explored further.

University press officers, researchers and scientific journals also have a key part to play in improving the quality of research reported in the media. A content analysis[27] revealed that academic press releases play an influential role in the quality of news articles but highlighted that many of the exaggerations of media articles stemmed from exaggerations in academic press releases. Nevertheless, the best quality newspaper articles are based on scientific research (usually based in a university) that is published in a scientific journal

rather than unpublished research promoted by PR agencies. Improving the quality of reporting in the news perhaps lies firstly with universities and scientific journals providing easier to understand information that can be understood by a non-specialist audience. Scientific journals may prefer to disseminate press releases on some days more often than others which could contribute to the differences by day of the week. Some newspapers were more likely to report on studies that were not from scientific journals, and therefore one recommendation is to encourage all newspapers to increase the proportion of articles based on published studies and to cite the study in the newspaper article.

Previous research has highlighted that the mass media can be an effective tool health professionals can utilise as a way to increase public knowledge of aspects of public health such as physical activity[6 7] or drink-driving[28] and therefore it is beneficial for scientists to work with the media more closely to increase the proportion of high quality articles. The best quality articles are more likely to have certain attributes. Higher quality articles are more likely to be written by a named journalist (with a by-line), often with a declared interest in health however, a third had no name provided. It has previously been suggested that the un-named author may know less about health issues and have had little training in this area[29] however, this is not necessarily true. Health journalists could be more likely to publish articles without a by-line due to differences in editorial policy between newspapers. Articles that have come from press releases may be more likely not to have a by-line and therefore we support more transparency on the source of the information and recommend that more nutrition articles are published by a trained health journalist. Although we did not conclude that article size was a key factor when other factors were taken into account we believe that articles need to be large enough to cover many of the main points, a finding reported in previous research[10 18]. It is unclear what the optimum

size is for an article but it needs to be large enough to successfully provide sufficient context for readers to understand the main points of the research, the conditions attached to the research and the quality of the study design.

Training for journalists is available in the UK such as that provided at the Science Media Centre in London; although little is offered on nutrition and the Centre receives corporate funding which may mean it is not neutral. We recommend more rigorous training of journalists in scientific study design and more dialogue between journalists and scientists to improve the choice of studies covered in the news. A recent review of media quality in Australia concluded that although quality of news media was low, it had recently improved with benefits and harms more accurately provided. This was mainly limited to online news articles[30] but indicates that progress can be made. This will only be achieved if journalists, scientists and academic press offices work together as has previously been highlighted[31].

There are a number of notable limitations to this research. Data was only collected for a limited period from a limited number of papers. It is likely that there are differences between newspapers although we saw little difference between newspapers here. It is likely that some newspapers that we have not included are different in format and editorial policy and vary in the quality of their nutrition related articles. Therefore, it is possible that we have not captured a true picture of the quality of nutrition articles in all newspapers. It is also likely that fluctuations may occur when a nutrition topic of particular interest is covered in the news which may increase the proportion of larger articles written or the number of articles categorised under a particular health outcome. Importantly, most newspapers have reported declines in circulation figures as more people are turning to alternative sources e.g. online news websites and blogs[32], although the newspapers that we included in our survey (mostly tabloids) did also have an online presence. Many additional

articles will have been published on the online version but we did not explore this. More research is required to assess online sources of news in order to capture a true picture of the quality of nutrition related articles. A validated tool to assess quality from online news sources is urgently needed in order to achieve this. Some of the methods used to measure article attributes do not have universally agreed standards, for example methods for measuring article size. These methods are prone to measurement error and could be improved in future.

In conclusion, it was highlighted in the 1990s[33] that health research was often misrepresented and preliminary research reported as a breakthrough. These findings are mirrored in our study, indicating that despite steps being taken to improve the situation many of these issues still persist. It is therefore essential that further measures are made to improve the quality of nutrition coverage and minimise the damage to public health[34 35 36]. Firstly, we propose that journalists have adequate training in issues related to scientific methods and health. Secondly, newspaper editors should consider publishing a smaller number of higher quality articles based on studies published in scientific journals. Thirdly, researchers, health professionals, university and journal press officers are key and could assist in providing clear information which follows a standard format to media sources as well as support with training. Finally, all parties need to work together to ensure that nutrition coverage and health messages published for the public are both clear and informative as well as interesting and exciting. Establishing common ground between stake-holders is central to improvement.

Contributors

CE provided the original research idea, supervised the research, wrote the first draft of the discussion, analysed the data and critically reviewed the first and subsequent drafts of the manuscript. AK checked and contributed to analysis of the data, wrote the first draft of the manuscript and contributed to all subsequent drafts. NA and NJ contributed to the design of the survey, collected the data, contributed to the analysis of the data and reviewed the final draft of the manuscript.

Competing Interests

We have no competing interests.

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Data sharing statement

No additional data are available for analysis.

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Quality assessment of nutrition coverage in the media: A 6 week survey of five popular UK newspapers

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ABSTRACT

Objectives: to investigate the quality of nutrition articles in popular national daily newspapers in the UK and to identify important predictors of article quality.

Setting: Newspapers are a primary source of nutrition information for the public.

Design: Newspaper articles were collected on 6 days of the week (excluding Sunday) for 6 weeks in summer 2014. Predictors included food type and health outcome, size of article, whether or not the journalist was named and day of the week.

Outcome measures: A validated quality assessment tool was used to assess each article, with a minimum possible score of -12 and a maximum score of 17. Newspapers were checked in duplicate for relevant articles. The association of each predictor on article quality score was analysed adjusting for remaining predictors. A logistic regression model was implemented with quality score as the binary outcome, categorised as poor (score less than zero) or satisfactory (score of zero or more).

Results: Over 6 weeks 141 nutrition articles were included across the 5 newspapers. The median quality score was 2 (interquartile range -2 to 6) and 44 (31%) articles were poor quality. There was no substantial variation in quality of reporting between newspapers once other factors such as anonymous publishing, health outcome, aspect of diet covered and day of the week were taken into account. Particularly low quality scores were obtained for anonymously published articles with no named journalist, articles that focussed on obesity and articles that reported on high fat and processed foods.

Conclusions: The general public are regularly exposed to poor quality information in newspapers about what to eat to promote health, particularly articles reporting on obesity. Journalists, researchers, university press officers and scientific journals need to work together more closely to ensure clear, consistent nutrition messages are communicated to the public in an engaging way.

ARTICLE SUMMARY

- A large number of nutrition articles from newspapers were analysed for article quality using a validated quality assessment tool
- Key factors were tested for prediction of article quality adjusting for other factors
- Newspaper articles were collected over 6 weeks but longer time periods may be needed to explain some of the differences in article quality due to variation in quality each week
- Popular sources of news such as online newspaper articles and news on social media were not included in the analysis.

INTRODUCTION

Chronic conditions such as obesity, cardiovascular disease (CVD), type II diabetes and stroke are leading causes of death, accounting for 86% of total deaths in the UK[1]. As a result of lifestyle factors such as poor diet, physical inactivity, and excess weight playing key roles in the development of these chronic conditions[2 3], 33,000 deaths each year could be avoided if the UK dietary recommendations were met[4]. Raising knowledge and awareness of dietary guidelines in an effort to educate and encourage the public to make a conscious decision about their dietary intake could help to significantly improve the health of the population and reduce the incidence of these conditions[5].

The media is comprised of the internet, radio, television, smartphones, and printed newspapers and media communications, many of which have been shown to have an influential effect on the public's knowledge and awareness of health issues, and which therefore have the potential to promote positive behaviour change[6 7]. Only a decade ago, tabloid and broadsheet newspapers were the primary source of health based information[8], however news from social media sources such as Facebook and Twitter are now popular. Nevertheless, despite a dramatic increase in the use of online media[9], printed newspapers remain an efficient way of providing the public with essential information to enable them to make informed decisions[10 11].

Previous research has shown that nutrition coverage has often been sensationalist, with the headlines not accurately reflecting the scientific research[12] and based on reporting preliminary research as a "breakthrough"[13]. The media have been criticised for their classification of "newsworthy" stories[13] and one study reported that 72% of articles were based on low quality scientific evidence[10]. It is common to present contradictory messages or an unbalanced view about health and nutrition in many media articles[14-16]. On the other hand, newspapers do not exist to provide a free public health service to the public but to provide newsworthy articles[17].

A review of the quality of 160 health based articles (although not necessarily nutrition related articles) in eight UK newspapers over 4 weeks revealed significant differences in the quality of reporting between newspapers[18] with *The Times* publishing the highest quality articles and *The Sun* the lowest. Their findings highlighted aspects of an article related to editorial policy that affected the quality of reporting such as article length, journalist, and credibility of source; however they did not explore how these predictors of quality explained variation in quality by paper type or whether they interacted with each other. Therefore, the main aims of this study were to use the existing validated quality assessment tool by Robinson et al[18] to assess the quality of nutrition coverage in particular in five of the highest circulating printed newspapers and to determine the most important predictors of article quality to explain any differences in article quality between papers. We also made recommendations to improve the quality of future nutrition and health reporting in the media.

METHODS

Data collection

Five of the highest six circulating tabloid and broadsheet national newspapers in the UK were examined in the summer of 2014. Four tabloid newspapers (*The Sun*, *The Daily Mirror*, *The Daily Mail* and *The Daily Express*) and one broadsheet, (*The Daily Telegraph*) were included in this study. We omitted the Daily Standard from the included list, as it is not available outside London. Both tabloid and broadsheet newspapers were included to understand whether there were any differences in predictors of quality of the nutrition coverage in these forms of media. Audiences vary between the two types of newspaper with tabloids generally targeting audience with a lower socio-economic background[19].

Printed editions of the five newspapers were collected on 6 days of the week (Monday to Saturday) for 6 weeks from 30 June 2014 to 9 August 2014. Sunday was excluded from the data collection as a pilot study revealed repetition of nutrition/health articles from previous days. Each printed newspaper was scanned by a researcher in its entirety. Articles covering an aspect of nutrition (as an exposure) and an

aspect of human health (as a health outcome) were identified and extracted for inclusion in this study. Articles were excluded if a) they covered nutrition but without a related health outcome (for example the use of cucumber as a beauty therapy); or b) they covered a health outcome such as heart disease without discussing diet. Articles from opinion columns were also excluded. This process was carried out in duplicate and independently by a second researcher and the selected articles were reviewed by a third nutritionist. Articles that did not adequately meet inclusion criteria were excluded.

Where sufficient information was provided, original research was located using PubMed and other online databases. Articles with insufficient information to locate original research or not based on published research were not excluded. Each article was coded with a unique ID number. Descriptive data such as, the newspaper title, article size, date and day of publication and journalist's name, were extracted for each article. Articles were categorised into aspect of diet and health outcome covered in the publication. Dietary components were broadly categorised according to The Eatwell guide[20] but with high fat and high sugar foods separated into different food categories as these are usually covered separately in the media.

The size of the article in column inches was measured using a standard method (column inches high x number of columns). Articles were then categorised into either small (≤ 19.9 inches), medium (20 – 34 inches) or large (≥ 35 inches) based on space allocated to articles. The cut-off points for these categories were based on the average column inches for less than half page, half a page and more than half a page. Articles were categorised as being anonymous with no journalist name provided or as named if the author of the article was provided (known as a by-line).

Quality Assessment Measure

Each article was reviewed and graded using a validated quality assessment tool[18]. The tool assessed different aspects of reporting quality such as generalisability and significance of findings, editorial content, credibility of source, and representativeness of research used. The tool consists of 21 items,

and points were awarded or deducted based on whether the article met the criteria. Items 1-8 and 18-21 were considered essential criteria, for these questions, points were deducted if the criteria were not met. Items 9-17 were considered desirable and points were awarded if the criteria were met and zero if the criteria was not met (see the complete list of questions published by Robinson et al[18]). Articles could receive a maximum of 17 points or minimum of -12. Following grading, articles were categorised based on the quality score (as recommended by Robinson et al[18]) with poor quality articles scoring less than zero, satisfactory articles scoring zero to ten and high quality articles scoring more than ten.

Statistical analysis

Descriptive statistics were conducted to obtain frequencies, median values and interquartile range for quality score. In all the models, due to the lack of normality in the distribution of quality scores, the scores were categorised into two groups; poor (quality score of less than zero) or satisfactory (quality score of zero or above) based on the work by Robinson[18]. Descriptive data were provided for the different categories of food and health covered by the articles, anonymous reporting, article size and days of the week including median and interquartile range of quality score for each category. Logistic regression models were generated with article quality score as poor or acceptable as the binary outcome variable. In the first model differences in quality score by newspaper type were tested without adjusting for any predictor variables. The newspaper that published the most articles was used as the reference category. Pairwise comparisons between papers were reported with Bonferroni corrections (to reduce the risks involved with multiple-testing). In the second model, predictors were included in the model namely; day of publication, article size, whether there was a named author (by-line), the health-outcome reported and food type covered in the article. In both models, due to the number of weeks sampled being a smaller subset of weeks over the year the results were clustered within weeks using a sandwich estimator[21]. To determine whether newspaper type and each predictor were explaining significant amounts of variation in quality score we took a nested model approach. A likelihood ratio test was used with each factor in turn, comparing the model without and with each factor and P values of each test were reported. The reference category for each variable was the most common category

which had the largest number of articles and each of the remaining categories were compared with the reference in the tables. Pairwise comparisons with Bonferroni corrections were reported. Residuals of the models were checked for approximate normality. Analysis was conducted using StataIC 14 with level of significance set at P-value of <0.05. Key aspects of the articles identified by the quality assessment tool that were particularly unlikely to be met were discussed as well as any substantial differences between newspapers.

RESULTS

Descriptive Analysis

In total, 141 different articles were published over the 6 week period (see table 1) in the five newspapers. Five articles on heart disease were excluded, which were initially included, as they focussed on statins rather than dietary intake. A mean of 24 articles were published each week and a mean of four articles were published each day. *The Daily Mail* had the most publications relating to nutrition and health over the period studied (n = 40). Their articles accounted for 28.4% of the total publications and therefore was used as the reference category in subsequent analysis. In contrast, *the Sun* published the fewest articles (n = 20), accounting for 14.2% of the total publications. Papers varied in the proportion of small articles and anonymous articles and none of the papers published high quality articles as defined by the quality assessment tool (see table 1).

Table 1: Descriptive information on quality scores, article size and whether named journalist listed by newspaper name (*IQR=Interquartile range)

Newspaper	N (%)	Quality score		Quality category (%)		Article size N (%)			
		Median	**IQR***	**Poor**	**Satisfactory**	**Small**	**Medium**	**Large**	**Journalist(%)**
The Sun	20 (14)	0.5	-5.5 to 4	9(45)	11(55)	14(70)	0 (0)	6 (30)	12 (60)
The Daily Mirror	23 (16)	1	-2 to 7	7(30)	16(70)	15 (65)	2 (9)	6 (26)	17 (74)
The Daily Mail	40 (28)	2	-1.5 to 4.5	13(33)	27(67)	21 (53)	11 (28)	8 (20)	25 (63)
The Daily Express	30 (21)	2.5	-1 to 6	8(27)	22(73)	14 (47)	6 (20)	10 (33)	24 (80)
The Daily Telegraph	28 (20)	3	-1.5 to 7.5	7(25)	21(75)	23 (82)	5 (18)	0 (0)	20 (71)
Total	**141 (100%)**	2	-2 to 6	**44(31)**	**97(69)**	**87 (62%)**	**24 (17%)**	**30 (21%)**	**98 (70%)**

Quality assessment

The quality scores across the newspapers ranged from -9 to 10, with an overall median score of 2. In total, 44 (31.2%) articles were rated poor quality (score of less than zero) and 97 (68.8%) were rated satisfactory quality (score of 0-10). There were no high quality articles (score of more than 10). The median quality scores varied between paper type; the lowest being 0.5 for The Sun and the highest being 3 for the Daily Telegraph. The percentage of articles that achieved a score of zero or above (and therefore defined as satisfactory quality) varied between papers and was lowest for the Sun at 55% and highest for the Daily Telegraph at 75% (see table 1). Median scores for week 1 to 6 varied and were -4, 3, 3, 0, 3.5 and 5 consecutively. Weeks were adjusted for in the analysis. Logistic regression results using The Daily Mail as the reference category indicated there was an overall significant effect of newspaper type on percent of articles of satisfactory quality ($p<0.01$) but none of the individual papers had a significantly different percent of satisfactory articles compared with the Daily Mail and none of the pairwise comparisons were statistically significant.

We investigated the importance of five different predictor variables. Quality scores varied by day of the week. Median scores for Monday to Saturday were 1, 0, 0, 4, 4 and 2 respectively with higher scores on Thursday and Friday and lower scores on Tuesday and Wednesday. More articles were published on Tuesday than any other day and therefore this was used as the reference category in subsequent analysis.

There were 48 named journalists across the 141 articles. These journalists were responsible for publishing 98 (69.5%) of the articles reviewed. The remaining 43 (30.5%) articles were published anonymously (table 1). The Sun had the highest number of anonymous

publications (n = 8, 40.0%) and The Daily Express had the least (n= 6, 20%). Articles with a named journalist had a median quality score of 3 compared with a median score of -2 for articles that were anonymous.

The majority of articles were categorised as small (n=87, 61.7%), (table 1). Small, medium and large articles had median quality scores of 1, 3.5 and 5 respectively. *The Daily Express,* had the greatest number of large sized articles (n = 10, 33.3%) while the broadsheet, *The Daily Telegraph,* had the largest number of small articles (n=23, 82%) (see table 1).

The majority of articles discussed diet and nutrition in relation to their effect on health and wellbeing. Conditions covered most often were obesity (n = 35, 24.8%), CVD (n = 34, 24.1%) and neurological disorders (n = 22, 15.6%). The main dietary components covered energy (n = 27, 19.1%) and fruits and vegetables (n= 25, 17.7%). Quality scores varied across different health outcomes and different food topics (see table 2). Articles focussing on obesity were of the lowest quality compared with all other health categories (table 2) with a median quality score of -1. Out of the different food topics covered, high fat and processed foods had the lowest quality score with a median of zero.

Table 2. *Number, percent, median scores of article quality and Interquartile Range (IQR) for each of the eight different categories of food type and 8 different categories of health outcome. A higher score indicates a higher quality newspaper article*

Category	N	%	Median score	IQR
Food Categories				
Energy (Kcals)	27	19	1	-3 to 4
Alcohol	18	13	3.5	0 to 5
Fruit and vegetables	25	18	3	-3 to 7
High fat & processed foods	21	15	0	-2 to 2
Protein and Dairy foods	21	15	3	0 to 6
Dairy foods	13	9	1	-1 to 6
Sugary drinks & confectionery	9	6	3	-4 to 7
Other (vitamins & ingredients)	20	14	3	-1.5 to 6.5
Health Categories				
Cancers	8	6	2.5	-0.5 to 7
Cardiovascular health	34	24	4	0 to 8
Diabetes	17	12	4	2 to 6
Obesity	35	25	-1	-4 to 2
Neurological disorders	22	16	2.5	0 to 5
Life expectancy	10	7	3.5	-3 to 5
Other (Respiratory, endocrine or reproductive, muscular skeletal)	15	11	3	-2 to 4
Overall	**141**	**100%**	**2**	**-2 to 6**

We investigated which of the different factors were important at predicting article quality when all the predictors were included in a logistic regression model and where each was adjusted for the remaining predictors. The full model explained 34% of the variation in article quality score. The odds ratios (the odds of an article being defined as satisfactory for each category compared with the odds for the reference category) are displayed in table 3.

Likelihood ratio tests used to test the contribution of each variable to the model indicated that paper type was not a significant predictor of article quality once other factors were

taken into account (see table 3). Article size was also not a significant predictor of article quality when other factors were taken into account. However day of the week, food category, health category and whether the journalist was named were all significant factors (see table 3) predicting article quality.

For day of the week, compared with the reference category of Tuesday, Monday had significantly higher odds of having a satisfactory score with articles published on Monday having nearly 4 times the odds of receiving a satisfactory score compared with Tuesday when adjusted for other factors. Articles published on Saturday had particularly low scores with significantly lower odds of having a satisfactory score compared with Tuesday and also Thursday (the latter result from pairwise comparisons) when adjusted for other factors. These results are different from the unadjusted figures where articles on Tuesday received a lower score than Saturday indicating that other known or unknown factors that reduce quality score may be more common on Saturdays. Compared with articles reporting on obesity, articles reporting on Cancer, CVD and Diabetes had more than 10 times the odds of receiving a satisfactory quality score. No pairwise comparisons were statistically significant. Articles with no by-line were far less likely to receive a satisfactory score. Although food categories made a significant contribution overall to article quality score no pairwise comparisons were statistically significant.

Table 3: Predictors of quality score for different factors including paper type, week, day, food category, health category, named journalist and article size.

Factors predicting article quality score	n	Odds Ratio (OR)	95% CI OR	P value for comparison with ref	P value for likelihood ratio test
Paper title: reference category is	**40**				0.95

The Daily Mail					
The Sun	20	0.80	0.03 to 25.21	0.90	
The Daily Mirror	23	0.60	0.07 to 4.84	0.63	
The Daily Express	30	0.78	0.10 to 5.83	0.81	
The Daily Telegraph	28	0.78	0.16 to 3.88	0.77	
Day: reference category is Tuesday	**35**				<0.01
Monday	27	3.90	1.09 to 13.92	0.04	
Wednesday	25	3.83	0.31 to 47.20	0.30	
Thursday	25	13.64	0.65 to 287.6	0.09	
Friday	15	6.94	1.02 to 47.19	0.05	
Saturday	14	0.21	0.09 to 0.53	<0.01	
Food: reference category is Energy	**27**				0.03
Alcohol	18	3.72	0.41 to 34.19	0.25	
Fruit and vegetables	25	0.66	0.04 to 11.81	0.78	
High fat and processed foods	21	0.39	0.02 to 8.49	0.55	
Protein and Dairy foods	21	4.66	0.36 to 60.27	0.24	
Sugary drinks and confectionery	9	1.56	0.25 to 9.67	0.63	
Other (vitamins, ingredients)	20	0.86	0.06 to 12.17	0.91	
Health: reference category is obesity	**35**				0.03
Cancer	8	24.30	3.17 to 186.2	<0.01	
CVD	34	11.73	2.69 to 51.24	<0.01	
Type 2 Diabetes	17	12.31	1.55 to 98.04	0.02	
Neurological disorders	22	7.18	0.85 to 60.84	0.07	
Life Expectancy	10	1.75	0.10 to 30.17	0.70	
Other (respiratory, reproductive)	12	3.61	1.04 to 12.61	0.04	
Named journalist: reference category is Yes	**98**				<0.01

No named journalist	43	0.10	0.01 to 0.84	0.03	
Article Size: reference category is small	**82**				0.52
Medium sized articles	36	0.92	0.66 to 2.78	0.88	
Large sized articles	23	2.79	0.66 to 11.75	0.16	

We investigated which of the 21 questions making up the quality score for each newspaper scored particularly badly. Table 4 provides a breakdown of the scores for each of the 21 items for individual newspapers. The analysis revealed that 54% of articles ranked negatively for Q1 and 40% ranked negatively for Q2, which meant that more than half the articles were not based on published research or did not cite the journal of publication and nearly half did not provide an author name. It would be particularly difficult to locate and read the original research article without this information. The newspapers differed in what proportion of their articles met these two criteria. The majority of articles omitted essential information such as number of participants (Q4), and whether the findings differed from previous research (Q5) [61% and 73% retrospectively] but these results did not vary substantially by newspaper. Furthermore, the majority (90%) of articles did not state whether the results of research were statistically significant (Q11). *The Daily Express* had the most negatively scored articles for Q19, meaning the article had the "potential to cause undue harm or optimism". *The Sun* and *The Daily Express* were most likely to score negatively for Q21, stating a "breakthrough" or "cure" in articles. The majority of articles (70%) quoted a second opinion from a specialist (e.g. health professional, nutritionist, or academic). Different newspapers scored differently on different questions although no newspaper scored poorly on all questions.

Question	The Sun (n = 20)		Daily Mirror (n = 23)		Daily Mail (n=40)		Daily Express (n=30)		Daily Telegraph (n = 28)		All papers (n = 141)	
Criteria 1	+1	-1	+1	-1	+1	-1	+1	-1	+1	-1	+1	-1

Table 4. Percentage of articles meeting and not meeting the criteria for each of the 21 items in the validated quality assessment tool. Results presented for individual papers and for all papers combined. For each item met, a value of +1 (criteria 1 and 2) or zero (criteria 3) is achieved and for each item not met, either a zero (criteria 2) or -1 (criteria 1 and 3) is achieved.

Q1	20	80	61	39	37	63	57	43	54	46	46	54
Q2	35	65	52	48	55	45	80	20	71	29	60	40
Q3	70	30	78	22	80	20	90	10	82	18	81	19
Q4	25	75	26	74	43	57	40	60	54	46	39	61
Q5	15	85	26	74	27	73	33	67	29	71	27	73
Q6	35	65	43	57	30	70	33	67	36	64	37	63
Q7	45	55	70	30	77	23	70	30	79	21	70	30
Q8	75	25	78	22	70	30	70	30	71	29	72	28
Criteria 2	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**0**
Q9	10	90	17	83	25	75	40	60	21	79	24	76
Q10	20	80	17	83	20	80	17	83	18	82	18	82
Q11	15	85	9	91	5	95	10	90	14	86	10	90
Q12	0	100	0	100	5	95	13	87	4	96	5	95
Q13	0	100	0	100	0	100	3	97	4	96	1	99
Q14	0	100	4	96	5	95	0	100	0	100	2	98
Q15	15	85	35	65	15	85	10	90	25	75	19	81
Q16	70	30	78	22	70	30	80	20	50	50	69	31
Q17	25	75	26	74	15	85	17	83	14	86	18	82
Criteria 3	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**
Q18	5	95	9	91	3	97	0	100	0	100	3	97
Q19	20	80	22	78	28	72	37	63	29	71	28	72
Q20	10	90	13	87	15	85	17	83	11	89	13	87
Q21	20	80	17	83	10	90	23	77	7	93	15	85

284

DISCUSSION

This is the first study that explores in detail a range of predictors of quality of nutrition related articles. We found that there were differences between papers in the percent of articles with an acceptable quality score when no predictor variables were included in the model. However when predictors such as food and health type reported in the article and whether there was a named journalist were taken into account there was little variation between different newspapers. Therefore the main differences in article quality were explained by the article content and author of the article. Quality of articles also varied by day of the week. These differences in article quality could possibly be related to editorial policy and other factors that were not considered here however these factors explained a third of the variation in percent of articles reaching an acceptable quality level. Articles with the lowest quality scores were those covering obesity and high fat and processed foods and written anonymously. The poor quality of articles on obesity was particularly worrying. Poor quality reporting can lead to readers being confused or uninterested in the poor information provided[22]; a serious concern given that obesity affects a quarter of the UK adult population[23] and many readers may rely on information from newspapers about how to lose weight[24]. There are high levels of stigma around the subject of obesity and its possible causes and solutions which may lead to journalists (as well as health professionals) potentially including information in their communications that is based on their belief system as well as the scientific evidence[25].

Journalists have the complex role of translating scientific information to the lay public and it is important that the authors have sufficient understanding to ensure the correct balance between portraying scientific information accurately and making the information clear and readable. On the other hand, journalists must make the story "eye-catching" and

"appealing" for the public, which can lead to nutrition articles containing sensationalist reporting, alarmist headlines or contradictory information, resulting in confusion or distrust of dietary recommendations[14 26]. Journalists are in a position to shape social norms and attitudes through their choice of topics to publish and therefore may influence understanding of, and appetite for, particular stories but ultimately the role of journalists is to provide news that is interesting and sells newspapers and not to act as a public health service to the masses. Of the five newspapers reviewed, *s*ome papers published more nutrition articles than others, a finding which is consistent with previous research[18]. However, it may be more beneficial to the public to have fewer higher quality articles rather than many articles of low quality. Articles may be published in newspapers if the editors believe it will be of interest to readers and therefore a large number of articles can be seen as a positive sign that readers (the public) are interested in nutrition and health. On the other hand, the public do not want poor quality reporting. One study reported that more than three quarters (81%) of those surveyed said they only wanted to hear about findings once "there is acceptance among nutrition and health professionals"[27]. The current situation needs to take these views into account. We did not collect relevant information to determine why quality of articles varied by day and the reasons for this need to be explored further.

University press officers, researchers and scientific journals also have a key part to play in improving the quality of research reported in the media. A content analysis[28] revealed that academic press releases play an influential role in the quality of news articles but highlighted that many of the exaggerations of media articles stemmed from exaggerations in academic press releases. Nevertheless, the best quality newspaper articles are based on scientific research (usually based in a university) that is published in a scientific journal

rather than unpublished research promoted by PR agencies. Improving the quality of reporting in the news perhaps lies firstly with universities and scientific journals providing easier to understand information that can be understood by a non-specialist audience. Scientific journals have embargo policies which could contribute to the differences by day of the week. Some newspapers were more likely to report on studies that were not from scientific journals, and therefore one recommendation is to encourage all newspapers to increase the proportion of articles based on published studies and to cite the study in the newspaper article.

Previous research has highlighted that the mass media can be an effective tool health professionals can utilise as a way to increase public knowledge of aspects of public health such as physical activity[6 7] or drink-driving[29] and therefore it is beneficial for scientists to work with the media more closely to increase the proportion of high quality articles. The best quality articles are more likely to have certain attributes. Higher quality articles are more likely to be written by a named journalist (with a by-line), often with a declared interest in health however, a third had no name provided. It has previously been suggested that the un-named author may know less about health issues and have had little training in this area[30] however, this is not necessarily true. Health journalists could be more likely to publish articles without a by-line due to differences in editorial policy between newspapers. Articles that have come from press releases may be more likely not to have a by-line and therefore we support more transparency on the source of information and recommend that more nutrition articles are published by a trained health journalist. Although we did not conclude that article size was a key factor when other factors were taken into account we believe that articles need to be large enough to cover many of the main points, a finding reported in previous research[10 18]. It is unclear what the optimum

size is for an article but it needs to be large enough to successfully provide sufficient context for readers to understand the main points of the research, the conditions attached to the research and the quality of the study design.

Training for journalists is available in the UK such as that provided at the Science Media Centre in London; although little is offered on nutrition and the Centre receives corporate funding which may mean it is not neutral. We recommend more rigorous training of journalists in scientific study design and more dialogue between journalists and scientists to improve the choice of studies covered in the news. A recent review of media quality in Australia concluded that although quality of news media was low, it had recently improved with benefits and harms more accurately provided. This was mainly limited to online news articles[31] but indicates that progress can be made. This will only be achieved if journalists, scientists and academic press offices work together as has previously been highlighted[32].

There are a number of notable limitations to this research. Data was only collected for a limited period from a limited number of papers. It is likely that there are differences between newspapers although we saw little difference between newspapers here. It is likely that some newspapers that we have not included are different in format and editorial policy and vary in the quality of their nutrition related articles. Therefore, it is possible that we have not captured a true picture of the quality of nutrition articles in all newspapers. It is also likely that fluctuations may occur when a nutrition topic of particular interest is covered in the news which may increase the proportion of larger articles written or the number of articles categorised under a particular health outcome. Importantly, most newspapers have reported declines in circulation figures as more people are turning to alternative sources e.g. online news websites and blogs[33], although the newspapers that we included in our survey (mostly tabloids) do also have an online presence. Additional

articles will have been published on the online version but we did not explore this. More research is required to assess online sources of news in order to capture a complete picture of the quality of nutrition related articles. A validated tool to assess quality from a range of online news sources is needed in order to achieve this. Some of the methods used to measure article attributes do not have universally agreed standards, for example methods for measuring article size. These methods are prone to measurement error and could be improved in future.

In conclusion, it was highlighted in the 1990s[34] that health research was often misrepresented and preliminary research reported as a breakthrough. These findings are mirrored in our study, indicating that despite steps being taken to improve the situation many of these issues still persist. It is therefore essential that further measures are made to improve the quality of nutrition coverage and minimise the damage to public health[35 36 37]. Firstly, we propose that journalists have adequate training in issues related to scientific methods and health. Secondly, newspaper editors should consider publishing a smaller number of higher quality articles based on studies published in scientific journals. Thirdly, researchers, health professionals, university and journal press officers are key and could assist in providing clear information which follows a standard format to media sources as well as support with training. Finally, all parties need to work together to ensure that nutrition coverage and health messages published for the public are both clear and informative as well as interesting and exciting. Establishing common ground between stake-holders is central to improvement.

Contributors

CE provided the original research idea, supervised the research, wrote the first draft of the discussion, analysed the data and critically reviewed the first and subsequent drafts of the manuscript. AK checked and contributed to analysis of the data, wrote the first draft of the manuscript and contributed to all subsequent drafts. NA and NJ contributed to the design of the survey, collected the data, contributed to the analysis of the data and reviewed the final draft of the manuscript.

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Data sharing statement

No additional data are available for analysis.

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